3 1761 08154263 1

UNIV. OF
TORONTO
LIBRARY

1396

THE SCOTTISH GEOGRAPHICAL MAGAZINE

G
7
.S43
v.21

Authors are alone responsible for their respective statements.

THE SCOTTISH GEOGRAPHICAL MAGAZINE

PUBLISHED BY THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY
PROFESSOR JAMES GEIKIE, LL.D., D.C.L., F.R.S., HON. EDITOR
MARION I. NEWBIGIN, D.Sc., ACTING EDITOR

VOLUME XXI: 1905

82857
6/8/07

EDINBURGH
PRINTED BY T. AND A. CONSTABLE, PRINTERS TO HIS MAJESTY
AT THE UNIVERSITY PRESS
1905

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

PATRON.

HIS MAJESTY THE KING.

COUNCIL.

(Elected 10th November 1905.)

President.

PROFESSOR JAMES GEIKIE, D.C.L., LL.D., F.R.SS.L. and E.

Vice-Presidents.

His Grace The DUKE OF HAMILTON.
His Grace The DUKE OF MONTROSE, K.T.
The Most Hon. The MARQUIS OF TWEEDDALE, K.T.
The Most Hon. The MARQUIS OF LINLITHGOW, P.C., K.T., G.C.M.G., G.C.V.O.
The Right Hon. The EARL OF CRAWFORD AND BALCARRES, K.T., LL.D., F.R.S.
The Right Hon. The EARL OF WEMYSS AND MARCH, LL.D.
The Right Hon. The EARL OF ABERDEEN, P.C., G.C.M.G., LL.D.
The Right Hon. The EARL OF STAIR.
The Right Hon. The EARL OF ROSEBERY, K.G., P.C., K.T., D.C.L., LL.D., F.R.S., F.S.A.
The Right Hon. The EARL OF MANSFIELD.
The Right Hon. The EARL OF CAMPERDOWN, LL.D.
The Right Hon. LORD FORBES.
The Right Hon. LORD ELPHINSTONE.
The Right Hon. LORD BALFOUR OF BURLEIGH, P.C., K.T., LL.D.
The Right Hon. LORD REAY, G.C.S.I., G.C.I.E., D.C.L., LL.D.
The Right Hon. Brigadier-General LORD PLAYFAIR, C.V.O., R.A.
The Right Hon. LORD OVERTOUN.
The Right Hon. LORD KINNEAR, LL.D.
The Hon. LORD STORMONTH DARLING, LL.D.
SIR DONALD CURRIE, G.C.M.G.
SIR JOHN MURRAY, K.C.B., D.Sc., PH.D., LL.D., F.R.SS.L. and E.
The EARL OF DALKEITH, M.P.
The Right Hon. LORD SALTOUN.

Chairmen of Centres.

Glasgow . . PAUL ROTTENBURG, LL.D.
Dundee . . I. JULIUS WEINBERG.
Aberdeen . . PROFESSOR J. A. THOMSON, M.A.

Ordinary Members of Council.

J. HORNE, LL.D., F.R.S.
ROBERT GOURLAY, LL.D., *Glasgow.*
JOHN CLARKE, *Aberdeen.*
LAURENCE PULLAR, F.R.S.E.
SIR COLIN GEORGE MACRAE, W.S.
LIEUT.-COLONEL FRED. BAILEY.
H. B. FINLAY.
SIR JAMES A. RUSSELL, LL.D.
H. M. CADELL, B.Sc.
WM. B. WILSON, W.S.
COUTTS TROTTER.
JOHN GUNN, M.A., D.Sc.
KENNETH SANDERSON, W.S.
PROFESSOR CARGILL G. KNOTT, D.Sc., F.R.S.E.
SHERIFF CHARLES J. GUTHRIE, K.C., M.A.
J. B. SUTHERLAND, S.S.C.
ROBERT FULLERTON, M.D., *Glasgow.*
ALEXR. MACKAY, *Dundee.*
LIEUT.-COLONEL CAMPBELL.
J. YOUNG SIMPSON, D.Sc.
CHARLES SAROLEA, PH.D., D.LIT.
JOHN HARRISON.
JOHN KERR, LL.D.
WILLIAM BEARDMORE, *Glasgow.*
MAJOR-GENERAL P. C. DALMAHOY.
A. B. GILROY.
G. K. SMITH.
MAURICE PATERSON, B.A., LL.D.
HUGH BROWN, *Glasgow.*
VICTOR FRAENKL, *Dundee.*
D. F. LOWE, M.A., LL.D.
W. B. BLAIKIE, F.R.S.E.
CAPTAIN D. LIVINGSTONE BRUCE.
COLONEL T. CADELL, V.C.
COLONEL WARDLAW RAMSAY.
GEORGE SMITH, LL.D., C.I.E.
A. CROSBIE TURNER, *Glasgow.*
ROBERT S. ALLAN, *Glasgow.*
SIR GEORGE W. BAXTER, LL.D., *Dundee.*
BRIGADE-SURGEON LIEUT.-COL. JAMES ARNOTT, M.D.
HENRY A. R. CHANCELLOR.
JAMES J. DOBBIE, M.A., D.Sc., F.R.S.
CAPTAIN ALAN FOSTER.
JOHN GEDDIE, F.R.G.S.
A. P. LAURIE, M.A., D.Sc., F.R.S.E.
LIEUT. E. H. SHACKLETON.
W. F. G. ANDERSON, *Glasgow.*

Trustees—JAMES CURRIE, M.A., F.R.S.E.; JAMES R. REID, C.I.E.; F. GRANT OGILVIE, M.A., B.Sc.; WILLIAM C. SMITH, K.C., M.A.; and the Honorary Treasurers, *ex officio.*

Honorary Treasurers—JAMES CURRIE, M.A., F.R.S.E., Edinburgh; ROBERT GOURLAY, LL.D., Bank of Scotland, Glasgow.

Honorary Secretaries—RALPH RICHARDSON, W.S., F.R.S.E.; JOHN GEORGE BARTHOLOMEW, F.R.S.E.
Glasgow: A. CROSBIE TURNER, 65 Bath Street.
Dundee: DAVID WYLIE, 38 Reform Street.
Aberdeen: R. W. K. BAIN, 375 Union Street.

Honorary Editor—PROFESSOR JAMES GEIKIE, D.C.L., LL.D., F.R.SS.L. & E.

Honorary Librarian—J. BURGESS, C.I.E., LL.D., F.R.S.E.

Honorary Map-Curator—COLONEL JAMES SCONCE.

Auditors—MACANDREW AND BLAIR, C.A.

Secretary and Treasurer—MAJOR W. LACHLAN FORBES (late R.F.).

Editor—MARION I. NEWBIGIN, D.Sc.

Chief Clerk—GEORGE WALKER.

SOCIETY'S HALL: QUEEN STREET, EDINBURGH.

TELEPHONE 1989 CENTRAL.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

CONDITIONS AND PRIVILEGES OF MEMBERSHIP.

It is provided by Chapter I. § IV. of the *Constitution and Laws* of the Royal Scottish Geographical Society, that—

"*The Ordinary Members shall be those who are approved by the Council, and who pay the ordinary annual subscription, or a composition for life-membership.*"

The Annual Subscription is One Guinea, and is payable *in advance* at the commencement of each Session. A Member may compound for Life-Membership by payment as follows, viz.:—When under ten years' standing, £20; when over ten and under twenty years, £15; when over twenty and under 30 years, £10; when over thirty years' standing, £5.

The Official Year, or Session, of the Society is from November 1st to October 31st. New Members are required to pay the Subscription for the Session in which they join the Society, at whatever period, and they are entitled to receive the ordinary publications of that Session. Resignations, to take effect, must be lodged with the Secretary *before* the commencement of a new Session.

The privileges of Membership include admission (with one Guest) to the Ordinary monthly Meetings of the Society, and the use of the Library and Map-Room. Non-resident Members may borrow books from the Library, but they must defray the cost of transit both ways. Each Member is entitled to receive, free by post, the *Scottish Geographical Magazine*, which is published monthly by the Society.

Branches of the Society have been established in Glasgow, Dundee, and Aberdeen, where periodical Meetings are held.

CONTENTS.

VOL. XXI: 1905.

No. I.—JANUARY.

PAGE

Editorial: The Value of Geography, ... 1

Botanical Survey of Scotland. III. and IV.—Forfar and Fife. By William G. Smith, B.Sc., Ph.D., University of Leeds, . . 4

The Scottish National Antarctic Expedition. Second Antarctic Voyage of the *Scotia*. By J. H. Harvey Pirie, B.Sc., M.B., and R. N. Rudmose Brown, B.Sc., ... 24

Letters from Morocco, ... 37

Proceedings of the Royal Scottish Geographical Society, . . . 41

Geographical Notes, ... 42

The Ben Nevis Observatories—Exploration in the Mentone Caves—Lake Baikal—The Uganda Protectorate—Sleeping Sickness in the Congo—"Rain-making" among the North American Indians—The Mylius-Erichsen Expedition—Flora and Fauna of the Falkland Islands—Antarctic Meteorology—The Scottish National Antarctic Expedition—The Argentine Government and Meteorology—Commercial Geography.

New Books, ... 50

Books received, ... 54

New Maps, ... 55

(*Maps, Portrait, and Illustrations.*)

No. II.—FEBRUARY.

Botanical Survey of Scotland. III. and IV.—Forfar and Fife. By William G. Smith, B.Sc., Ph.D., University of Leeds, . . 57

Letters from Morocco, ... 84

Proceedings of the Royal Scottish Geographical Society, . . . 96

PAGE

Geographical Notes, ... 97

The Province of North Brabant—The Exploration of the Caspian Sea—Climate of Shanghai—Gordon Memorial College at Khartoum—Lieutenant Boyd Alexander's Expedition—The Gila Valley, Arizona—Glaciation in North America—Proposed Biological Station in Greenland—The *Discovery* Antarctic Expedition—The British Association Meeting in 1905—The Geographical Association—General—Commercial Geography.

New Books, ... 108

Books received, ... 115

(*Diagram, Maps, and Illustrations.*)

No. III.—MARCH.

Botanical Survey of Scotland. III. and IV.—Forfar and Fife. By William G. Smith, B.Sc., Ph.D., University of Leeds, . . 117

Views on the Upper Nile, ... 126

The Mineral Matter of the Sea. By Professor R. D. Salisbury, . . 132

The Development of Rhodesia and its Railway System in Relation to Oceanic Highways. By J. T. P. Heatley, ... 137

Proceedings of the Royal Scottish Geographical Society, . . . 152

Geographical Notes, ... 153

The Lakes of Scotland and Denmark—Survey of Iceland—Expedition to Turkestan—The New Port for the Sudan—The Argentine Relief Ship—Amundsen's Expedition to the Magnetic Pole—The Ziegler North Polar Expedition—Peary's New Arctic Expedition—The *Discovery* Antarctic Expedition—General—Commercial Geography.

New Books, ... 162

Books received, ... 170

New Maps, ... 171

(*Maps and Illustrations.*)

No. IV.—APRIL.

The Sikhim Himalaya. By Douglas W. Freshfield, . . . 173

The Economic Expansion of the Congo Free State. By Ch. Sarolea, D.Ph., D.Litt., F.R.S.E., of Edinburgh University, Consul for the Congo Free State, ... 182

The Proposed Chair of Geography in the University of Edinburgh. By General Chapman, C.B., ... 197

Bathymetrical Survey of the Fresh-Water Lochs of Scotland. Under the direction of Sir John Murray, K.C.B., F.R.S., D.Sc., etc., and Laurence Pullar, F.R.S.E., ... 199

Argentine Antarctic Station. By R. N. Rudmose Brown, B.Sc., . . 207

Proceedings of the Royal Scottish Geographical Society, . . . 210

PAGE

Geographical Notes, ... 211

The Expedition to Western Tibet—Irrigation in Mesopotamia—Irrigation in the Punjab—Exploration of Lake Tanganyika—The East Africa Protectorate—The Kismayu Concession—The Macmillan Expedition—Lieut. Boyd Alexander's Expedition—The Geography of Bolivia—Exploration in New Guinea—Antiquity of Man in Victoria—Scottish Antarctic Expedition—The French Antarctic Expedition—General—Commercial Geography.

New Books, ... 221

Books received, ... 227

(*Maps and Illustrations.*)

No. V.—MAY.

The Geographical Results of the Tibet Mission. By Sir Frank Younghusband, K.C.I.E., Gold Medallist of the Royal Scottish Geographical Society, ... 229

The Expedition to Lhasa. By Ralph Richardson, Hon. Sec. R.S.G.S., . 246

Notes on a Journey in Bolivia and Peru around Lake Titicaca. By Arthur W. Hill, M.A., Fellow of King's College, Cambridge, and University Lecturer, Bombay, ... 249

The Proposed Anglo-Abyssinian Boundary in East Africa. By S. H. F. Capenny, ... 260

Pigmies in the Hebrides: A Curious Legend. By W. C. Mackenzie, F.S.A. (Scot.), ... 264

Geographical Notes, ... 268

Survey of the Oeschinen-See—A British "Glacier"—Survey of Iceland—The Gorge of Escoáin—The Township of Livingstone—The North-East Coast of Brazil—Land and Water in the Arctic Region—Proposed Biological Station in Greenland—General—Commercial Geography.

New Books, ... 277

Books received, ... 285

New Maps, ... 286

New Atlases, ... 288

(*Map and Illustrations.*)

No. VI.—JUNE.

The Evolution of the Map of Scotland—First Stage. By John E. Shearer, F.S.A. Scot., F.R.S.G.S., ... 289

Tristan D'Acunha, ... 301

On Geographical Method, ... 309

Notes on a Journey through British North Borneo. By Andrew Burt, . 312

Antarctica, ... 315

The Scientific Results of the National Antarctic Expedition, . . 318

Scottish National Antarctic Expedition.—Outline Map of Laurie Island, South Orkneys, 1903. By William S. Bruce, ... 322

PAGE

The Recent Voyage of the *Uruguay*. By R. C. Mossman, F.R.S.E., . 323

Obituary, ... 328

Geographical Notes, ... 329

Rainfall of Ben Nevis Observatory—The Indian Earthquake—The Nile Flood and Barometric Variations—The Argentine Antarctic Station—Peary's New Arctic Expedition—New North Polar Expedition—General.

New Books, ... 337

Books received, ... 343

(*Maps, Chart, and Illustrations.*)

No. VII.—JULY.

Recent Changes in the Crater of Stromboli. By Tempest Anderson, M.D., D.Sc., ... 345

In the Lipari Islands. By George Yeld, Editor of the *Alpine Journal*, . 347

Scottish Place-Names and Scottish Saints. By Ralph Richardson, . 352

East and West. By Victor Dingelstedt, Corresponding Member R.S.G.S. 361

The Antarctic Problem, ... 376

The Depression of Sistan in Eastern Persia. By Ellsworth Huntington, . 379

The Alexander-Gosling Expedition, ... 385

Geographical Notes, ... 388

Erratum: Rainfall of the Ben Nevis Observatories—The Kirghiz Steppe—Standard Time for India—The "Sunk Lands" of Missouri and Arkansas—The Glaciers of the Canadian Rockies—Renewed Activity of Mount Pelée—Surveys in the Eastern Pacific—The Ziegler Relief Expedition—Amundsen's Expedition to the Magnetic Pole—General—Commercial Geography.

New Books, ... 395

Books received, ... 399

New Maps, ... 400

(*Illustrations.*)

No. VIII.—AUGUST.

Some Results of the Scottish National Antarctic Expedition:

1. Introduction. By William S. Bruce, Leader of the Expedition, 401
2. Bathymetrical Survey of the South Atlantic Ocean and Weddell Sea. By William S. Bruce, ... 402
3. Deep-Sea Deposits of the South Atlantic Ocean and Weddell Sea. By J. H. Harvey Pirie, B.Sc., M.B., . . . 413
4. Meteorology. By Robert C. Mossman, F.R.S.E., . . . 417
5. Diego Alvarez, or Gough Island. By R. M. Rudmose Brown, B.Sc., ... 430

The Anglo-Portuguese Boundary in Central Africa. By S. H. F. Capenny. 440

Obituary, ... 445

PAGE

Geographical Notes, ... 446

The Distribution of the Population in Sweden—The Island of Sakhalin—Fayûm Flint Implements—Gorgona Island, Colombia—Results of the Scottish National Antarctic Expedition—The South Africa Meeting of the British Association—Honours for the Members of the Charcot Expedition—The Sociological Society—The Expedition to the Indian Ocean—Commercial Geography.

New Books, ... 451

Books received, ... 456

(*Maps and Illustrations.*)

No. IX.—SEPTEMBER.

Some Geographical Peculiarities of the Indian Peninsula. By Cameron Morrison, ... 457

The French Antarctic Expedition, ... 463

Bathymetrical Survey of the Fresh-Water Lochs of Scotland. Under the direction of Sir John Murray, K.C.B., F.R.S., D.Sc., etc., and Laurence Pullar, F.R.S.E., ... 466

Colonel Harding in Remotest Barotseland By S. H. F. Capenny, . 484

A Great Geographer: Elisée Reclus, 1830-1905. By Professor Patrick Geddes, ... 490

Geographical Notes, ... 496

The New Province of Bengal—Exploration of Labrador—Expedition to the Western Sierra Madre Mountains—The Bermuda Islands—The Sandhill Region of Nebraska—The Barclay-Macpherson Expedition—The Snowy Range of New South Wales—The South-Western Pacific—Peary's Arctic Expedition—General.

New Books, ... 504

New Maps, ... 511

(*Map and Illustrations.*)

No. X.—OCTOBER.

Address to the Geographical Section of the British Association, 1905. By Rear-Admiral Sir W. J. L. Wharton, K.C.B., F.R.S., . . 513

The Evolution of the Map of Scotland.—Second Stage. By John E. Shearer, F.S.A.Scot., F.R.S.G.S., ... 532

The Negritos of Zambales, ... 539

The Ziegler North Polar Expedition 543

A Great Geographer: Elisée Reclus. By Professor Patrick Geddes, . 548

Geographical Notes, ... 555

China and Tibet—The New Province of Bengal—Geology of Upper Assam—The Alexander-Gosling Expedition—The Phytogeography of the Bahamas—The Physiography of the Adirondacks—Ancient Antarctica—General—Commercial Geography.

New Books, ... 563

Books received, ... 568

(*Maps.*)

No. XI.—NOVEMBER.

PAGE

Seismological Studies. By Professor C. G. Knott, D.Sc., F.R.S.E., etc., . 569
The Basin of Lake Titicaca. By A. F. Bandelier, . . . 582
The Teaching of Geography in the Schools in Cuba, . . . 591
The Alexander-Gosling Expedition, ... 599
Proceedings of the Royal Scottish Geographical Society, . . . 603
Obituary, ... 604
Geographical Notes, ... 606

Report on the Progress of the Ordnance Survey—African Exploration—The Benue-Logone Route to Lake Chad—The Population of the French Congo—Major Powell Cotton's Expedition—New Polar Expedition—Peary's Arctic Expedition—The Duke of Orleans' Expedition—Scotia Bay Meteorological Station—General—Commercial Geography.

New Books, ... 615
New Maps, ... 621
Books received, ... 624

No. XII.—DECEMBER.

Geographical Notes on South Africa south of the Limpopo. By F. S. Watermeyer, Government Land Surveyor, ... 625
The South African Meeting of the British Association :—
1. The Tour of the Association. By Professor J. Y. Simpson, D.Sc., 637
2. Geography at the Association. By The Editor, . . . 643
Siberia : a Review, ... 652
Geographical Notes, ... 659

The Island of Sakhalin—French Expedition to Central Asia—Dr. Sven Hedin's New Expedition—The Province of Berar—Expedition to Mount Ruwenzori—The Climate of the Bahr-el-Ghazal—The Nordenskjöld Expedition to South America—Volcanic Eruption at Samoa—The Mylius Erichsen Expedition—International Antarctic Exploration—Amundsen's Expedition to the Magnetic Pole—General—Commercial Geography.

New Books, ... 669
Books Received, ... 673
Proceedings of the Royal Scottish Geographical Society, . . . 674
Report of Council, ... 676

(*Illustrations.*)

INDEX 685

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

EDITORIAL: THE VALUE OF GEOGRAPHY.

WITH the present issue we begin the twenty-first volume of the *Scottish Geographical Magazine*, and the occasion seems fitting for a review of our aims and ideals, a renewed statement of our objects. Month by month there appears in our front pages a detailed statement of the objects with which the Scottish Geographical Society was founded, so that these should be familiar to all. In brief, it may be said that our main object is "to press for the full recognition of the claims of geography as a branch of knowledge." That this full recognition has not yet been obtained is proved, if proof be needed, by a series of articles and letters which have recently appeared in the *Times*. In that journal on November 19 there appeared a long article on "Geography and War" by the Military Correspondent, whose words were driven home by a leading article of the same date, and followed up by a series of letters from Sir Clements Markham, as representing the Royal Geographical Society, Mr. Mackinder, Mr. Freshfield, Dr. Herbertson, and others. The prime object of the *Times* Military Correspondent is to point out the costly ignorance of geography which is constantly being displayed by the War Office, but, as he goes on to show, this ignorance is by no means confined to the War Office. "On all sides the neglect of geography leaves a trail of harm. It gives us constant friction in our international relations, and not infrequent wars; it leads our business houses into costly mistakes, and into sins of omission and commission; it does as much as anything else to permit immoral financiers to drain the capital of England by nefarious schemes; it leads to reckless writing in the press, and to the isolation of England in a hostile world."

It is not necessary to give other quotations from the *Times* article in order to make clear the indictment which its author brings against the nation, nor are we here immediately concerned with the practical

measures which he and other writers suggest in order to take away our reproach. It is sufficient to point out that the net result is to make it clear that the disease is not one of ignorance alone, but of ignorance complicated by indifference—a complaint infinitely more difficult to cure. The practical uses of geography have never been borne in upon the consciousness of the nation, its scientific value, largely no doubt on account of improper teaching in the past, has not been appreciated—hence its neglect. But our Society exists in order to make clear its great importance, so that in so far as the *Times* indictment applies to Scotland, it is an indication that so far at least we have failed in our purpose.

The Society has recently celebrated its majority by a large increase of membership—surely one of the most fitting modes possible of celebrating such an occasion. If this increase means, as we all hope it does mean, that an interest in geography is becoming more widespread in Scotland, it is an augury full of hope for the future. But it would be folly to shut our eyes to the fact that the increase has also its dangers. If it lead to a general lowering of standard, to a gradual modification of ideals, it will be little short of a calamity. The Society is not and cannot be a mere collection of geographical specialists, it must make a wider appeal; but it has a right to demand from its members a genuine sympathy with the work of geographical specialists, a willingness to strive for the advancement of the science, a real interest in the progress of geography.

What is the real case for geography? Not surely only that it is of great practical value, that ignorance of its teaching may be calamitous alike to nations and to individuals. Its supreme importance for the general public is undoubtedly that, if taught and studied aright, it may give a genuine insight into the methods and results of modern science. The development of science is the great glory of our own time, and in that development perhaps the most important element is that proof of the continuity of nature and of the universality of change, which we sum up in speaking of the theory of evolution—the theory which is rapidly modifying all departments of modern thought. This theory is probably most beautifully illustrated in that department of knowledge in which it was formulated in modern times, that is, in biology in the large sense. But the great difficulty has always been to get the general public to take biology—especially in its limited sense as consisting of botany and zoology—sufficiently seriously, to study it with care enough to allow its discipline to be of real value. A strenuous attempt has been made of late years to get over this difficulty by introducing the subject of nature study into schools, in the hope of thus giving the young sufficient knowledge of method and of detail to enable them later to appreciate the great generalisations. So far as it goes this is no doubt good, but most teachers find first that the very indefinite subject of nature study is very difficult to teach, and second that, except in the case of very little children, it suffers from the great disadvantage of being apparently remote from life. There is no doubt that the average adult is even more conscious than the adolescent of this apparent remoteness, which

is meantime an almost insuperable obstacle in the way of a spread of biological knowledge among non-specialists. It is here that the great usefulness of geography comes in. It has, and by definition must have, that direct human interest which is essential before a subject can become widely popular; and rightly taught and studied no subject, not biology itself, affords more beautiful examples of the interaction of organism and environment. Nay, rightly considered, is it not a mere branch of biology, the study of the interaction of one organism with its environment, animate and inanimate, and of the environment as it affects that organism?

It is good that the members of a progressive nation should have a wide and exact acquaintance with the main facts of geography, but it is more that they should appreciate the broad principles of adaptation and modification. Detailed knowledge in its place is good, but an encyclopædic knowledge of detail is never likely to become common, and would not perhaps be of great use if it were. One must not forget that books of reference are abundant, and that it is one part of our aim as a Society to make them readily accessible. It would therefore be a waste of energy for us to strive as an ideal to make even the main facts of world-geography common property. In the vast store of knowledge available in the modern world it is necessary to make a selection. Life is short and the world is wide, and facts which have no special relation to daily life may be a burden rather than a benefit. It is not necessary that every member of the Society should become a trained geographer. But of infinitely greater value than a knowledge of detail is surely that acquaintance with method which enables one to interpret aright facts whenever presented, that power of observation which not only sees the great phenomena of life but sees them in their relation to other phenomena, which can perceive changes in the apparently stable, which can utilise the experience of the past to form a conception of the probable direction which the change will take.

Again, one of the great sources of our national errors and stupidities is our incapacity to appreciate the value of expert knowledge. It is common in this connection to make one or other of the great departments of State the scapegoat, but the fact remains that it is a national characteristic that we are far too contemptuous of the expert, that again and again we have suffered severely for the neglect of the natural laws perceived by the few, have plumed ourselves upon our superiority to the faddist, and have in consequence been obliged to pay a heavy toll in blood and gold. Now it is true that geography is something more than, and something different from, a collection of material gathered by the natural sciences, but it nevertheless utilises such material as the basis of its generalisations, and it is therefore admirably adapted to act as an intermediary between the devotees of these sciences and the general public. It is part of the object of this *Magazine* to show that the geographer works with facts made clear by the labours of specialists in the different sciences, and therefore to attempt to break down gradually the barrier of prejudice which separates these specialists from the general public.

To sum up, the objects which have guided the management of the

Magazine in the past may be said to be threefold. First, to attempt to aid in the dissemination of geographical knowledge; second, to employ the facts of geography as revealed by progressive research as a discipline which shall make clear the methods and results of modern science; third, to act as an intermediary between scientific specialists and the general public, and thus to assist human progress by allowing the conclusions of science to be promptly applied in human affairs. It is with the hope of carrying out these objects in the future to a greater extent than in the past, that the *Magazine* enters upon its twenty-first year of publication.

BOTANICAL SURVEY OF SCOTLAND.

(*With Map and Illustrations.*)

III. and IV.—Forfar and Fife.

By William G. Smith, B.Sc., Ph.D., University of Leeds.

(*Continued from page* 628.)

Woodland and Tree Regions.

The chief social trees of the primeval forest of Forfar and Fife were probably:—Oak occupying the richer and deeper soils; Scots pine on poor soils or moderately drained peat; birch on open exposed parts and in the valley heads at the higher altitudes; and thickets of alder and willow along the margins of the swamps and streams. This naturally formed primitive forest has almost disappeared. The more fertile parts have been converted into farmland, while considerable tracts enclosed for pasturage are so heavily grazed by sheep or cattle that the growth of naturally sown trees is prevented. Natural afforestation is also checked on the wilder moorland by grazing, by the periodic burning of ling on the grouse moors, and by rabbits. Few of the existing woods are the result of natural seed dispersal, and their character depends largely on the planter. In spite of the artificial character of the existing woods, there is still evidence of the natural distribution of the chief trees, because only those trees which are suited to a locality can be successfully grown in woods.

The area north of Strathmore presents more variety in its types of woods than the other parts of Forfar and Fife. In traversing the country from Strathmore up one of the rivers flowing from the Grampians, the following are the chief types of woods:—

(1) Woods and parklands of mixed deciduous trees, with or without coniferous trees. These woods occur over the plain of Strathmore, and up the main streams as far as the picturesque gorges on the Grampian edge, such as, Woods of the Burn (North Esk), Cortachy (South Esk), Airlie and Ruthven (Isla), and Craighall (Ericht).

(2) The oak tends to become the dominant tree in the valleys among the hills, and it so alters the character of the ground vegetation that the woods may be distinguished as oak woods.

(3) Higher up the valley, where cultivated land is restricted to a narrow tract along the streams, the oak disappears and open thickets of birch remain.

(4) Woods of Scots pine with other conifers are a prominent feature high on the valley slopes and on the moorland.

(5) Larch woods are also common at considerable elevations; these have been distinguished in this survey in order to obtain information on the distribution of this valuable timber tree in Scotland, and to facilitate comparison with the larch forests of Southern Europe.

Examples of other woods are occasionally met with, and include spruce, alder, hazel, and ash; but in the present area they are too small to record specially.

South of Strathmore the hill-ranges on the present map do not exceed 1500 feet, except in the case of the Lomonds. There are fewer types of woods. The birch thicket is rarely found large enough to record, and the summits of the hills are treeless except for plantations of conifers. The oak wood is also considerably restricted by the encroachment of farmland and mixed woods. The general result of a comparison of the woods of Forfar and Fife with those recorded in earlier papers of the Survey, is that north of Strathmore the woods are those of Northern Perthshire, while south of Strathmore they resemble those of the Edinburgh district. It is therefore unnecessary to repeat here what has been said in these papers.

Oak Woods and Mixed Deciduous Woods.—The oak woods are the natural type of woodland, and are generally present in the narrow wooded gorges of the hills. The mixed deciduous woods are dotted over the lowlands, but as the hills are approached they become concentrated into the sheltered valleys of the larger streams. A certain proportion of the oak woods are of natural formation, but the mixed woods are evidently planted, and include trees which have been introduced into this part of Britain. The following are the more abundant indigenous trees and shrubs of the deciduous woods, given approximately in the order of abundance. Those marked with an asterisk are found chiefly in the lowland woods; the others attain a higher altitude in the upland oak wood or birch wood:—

Oak (*Quercus Robur*, L.).[1]
Birch (*Betula alba* agg. .
Wych Elm (*Ulmus montana*, Stokes .
*Ash (*Fraxinus excelsior*, L.).
Alder (*Alnus glutinosa*, Med. .
Willows (*Salix*, spp.).
Rowan (*Pyrus Aucuparia*, Ehrh.).
Hazel (*Corylus Avellana*, L.).
*Poplars *Populus*, spp. .
*Hawthorn *Cratagus Oxyacantha*, L. .
Sloe (*Prunus spinosa*, L.).
*Elder *Sambucus nigra*, L. .
*Bird Cherry (*Prunus Padus*, L.).
*Holly (*Ilex Aquifolium*, L.).

Common trees not regarded as natives are beech, sycamore, lime,

[1] The nomenclature of the London Catalogue, 9th edition, is followed throughout.

horse-chestnut, and Spanish chestnut; introduced coniferæ are a feature in the woods of many estates. The introduction of the beech from Southern Britain and Central Europe brought into the lowland oak woods a competitor which changed their character. The beech can adapt itself to many kinds of soil, and it is strongly social. Its shade-bearing and shade-producing powers render it a formidable rival to the oak, birch, and Scots pine of the original forest, which are all light-demanders unsuited to dense shade. In the lowland woods a close canopy of beech will almost clear the ground of vegetation, and even where widely planted it favours an undergrowth of plants suited to shade

Fig. 3.—Ground vegetation of Wood Hyacinth, Bracken, and Yorkshire Fog, under the open canopy of an Oak wood on the Coal Measures of Yorkshire.

(*Photo by Miss H. M. Sikes, Huddersfield.*)

and a moist atmosphere, and different from that found under the open canopy of the oak (compare Figs. 3 and 4). The production of moist and shaded woods also follows the planting of coniferous trees. Hence it is necessary to distinguish the mixed wood from the oak wood, not only on account of the difference in the trees, but quite as much from the nature of the ground vegetation. The sycamore and elm are also abundant in the mixed woods. Their presence favours an undergrowth intermediate between the deep shade of the beech wood and the open canopy of the oak wood.

Mixed deciduous woods occur as high as 900 feet in most of the Grampian valleys; above this they may still be found round farmhouses up to about 1000 feet. The following trees were observed in a small plantation at the farm of Wester Glasslie on the southern slopes of

the Lomonds at 1000 feet; ash and spruce (most abundant), sycamore, wych elm, Scots pine, larch, hawthorn, laburnum, and lilac (all in good condition); oak and beech were present, but somewhat wind-swept and stunted; a copper beech grew well in a sheltered spot. Oak occurs with birch at 900 feet in a wood in Glenprosen. Many of the hills round Perth are wooded to their summits (about 700 feet), oak being the chief tree, although beech attains a large size. Mountain elm

Fig. 4.—The effect of Beech on the undergrowth in a Yorkshire wood comparable in situation to that in Fig. 3.

(*From Geog. Journal*, 1903; *photo by W. B. Crumpe, Esq., M.A., Halifax.*)

and ash of a fair size occur here and there on the Sidlaws, in one case near the summit at 900 to 950 feet.

In a recent botanical survey of Yorkshire (Smith and Moss, 1903), it was found that oak was the dominant tree up to about 1000 feet. There was enough evidence to distinguish a lowland form of oak wood (upper limit about 500 feet) from an upland form. The ground vegetation of shrubs and herbaceous plants is much more varied in the lowland woods than in the more exposed conditions of the upland woods. From

a long list of plants given in that paper, the following are some characteristic species :—

Upland Oak Wood.	Lowland Oak Wood.
Trees.	*Trees.*
Quercus Robur, L.	*Quercus Robur*, L.
Betula pubescens, Ehrh.	*Fagus sylvatica*, L.
Pyrus Aucuparia, Ehrh.	*Fraxinus excelsior*, L.
Shrubby Forms.	*Shrubby Forms.*
Vaccinium Myrtillus, L.	*Acer campestre*, L.
Calluna Erica, DC.	*Ulex europæus*, L.
Salix aurita, L.	*Rosa arvensis*, Huds.
Herbaceous or Ground Forms.	*Herbaceous or Ground Forms.*
Hypericum pulchrum, L.	*Geum urbanum*, L.
Lathyrus montanus, Bernh.	*Circæa lutetiana*, L.
Potentilla sylvestris, Neck.	*Sanicula europæa*, L.
Galium saxatile, L.	*Caucalis Anthriscus*, Huds.
Solidago Virgaurea, L.	*Lamium Galeobdolon*, Cran.
Melampyrum montanum, Johnst.	*Epipactis latifolia*, All.
Luzula erecta, Desv.	*Paris quadrifolia*, L.
Carex pilulifera, L.	*Arum maculatum*, L.
Molinia varia, Schrank.	*Milium effusum*, L.
Lomaria Spicant, Desv.	*Poa nemoralis*, L.
Lastræa Oreopteris, Presl.	*Brachypodium gracile*, Beauv.

There is evidence of this same distinction in the Scottish woods, but the scanty number of typical oak woods makes the recognition of the two zones more difficult than in Yorkshire. The slopes of the Highland valleys still show the upland oak wood, but the lowland oak forest of the sheltered valleys has been almost entirely replaced by the mixed woods. The characteristic plants of the mixed woods of Forfar and Fife are very similar to those already given in that part of the Survey which deals with the Edinburgh district (1900 B.). In the part on Northern Perthshire a list is given of the ground vegetation of the oak coppice of the Tay basin, and this is represented in most of the upland oak woods in Forfarshire.

Birch Woods.—The occurrence of a birch wood may indicate—

(1) An oak wood from which the oak, originally dominant, has been removed, while the less valuable birches have been left, and along with naturally sown seedlings have in time formed a wood.

(2) A wood-clearing or a piece of moorland preserved from excessive grazing by sheep, deer, and rabbits. Under these conditions, birch seedlings and mountain ash frequently develop in such numbers that a thicket or wood results. Seedling Scots pines or oaks may also come with the birch, and nursed by it, may in time come to form a natural wood. The birch thus plays an important part in preparing the way for the natural rejuvenation of forest. In Forfar and Fife (as in the limestone districts of Yorkshire) the hazel, with or without the birch, forms similar thickets, the forerunners of forests of larger trees.

(3) The subalpine deciduous wood, the highest zone of woodland in the Highland valleys. Good examples of this occur in all the chief valleys of the Grampians of this area, and are indicated on the map. (See also Fig. 5.) Thus the birch and rowan, which are subdominant elements in the lower forest zones, become dominant forms near the moorland. Seedlings and trees have been frequently observed at considerable elevations, and under conditions more favourable to tree-

Fig. 5.—Birch Wood in Glen Clova, looking up the South Esk.
(*Reproduced by permission from photo by Francis Skeoch, Esq., Dundee.*)

growth than those existing on sheep pastures, grouse moors, and deer forests, it is extremely probable that natural thickets of birch, rowan, and perhaps hazel would be formed. Seedlings of birch and rowan were found on the moors from Glen Clova over Cairn O'Barns to Glenprosen up to an altitude of 1250 feet. The wych elm and hazel occur on Braedownie crags of the Red Craig of Clova at about 1000 feet. Birch and rowan are abundant amongst the larch and spruce of Balnagairn Wood, near the head of Glen Clova, at 1500 to 1750 feet; the dwarf birch (*Betula nana*) occurs in the peat hags on Broad Cairn and Sandy Hillock, above Balnagairn, at 2000 and 2500 feet. In Glen Isla, birch and rowan are

common in Caenlochan Forest (Fig. 6) (1500 to 2000 feet), and at similar elevations along with hazel on Duchray Crags. In the Sidlaws elm and birch occur at Lundie Crags (900 to 1000 feet). It seems therefore probable, from existing trees and the presence of buried stems in peat, that the moors of the present time were formerly covered with thickets of low trees up to altitudes of 1500 to 2000 feet, if not higher. Professor Dickie (1860) states: "On the summit of the ridge north of Mount Keen, and at an elevation of 2200 feet, I have seen the dead remains of birches far larger than any growing at lower altitudes on other mountains in the district."[1] In Yorkshire (Smith and Rankin, 1903) there is strong evidence that the existing treeless moors were covered with birch thickets up to altitudes from 1500 to 1750 feet.

Woods of Coniferous Trees.—Scots pine and larch are the chief forest trees of this area. Spruce is not uncommon, although it is rarely an important constituent of a wood. Many introduced conifers have been planted and have attained considerable size in the lowland woods of the district; these, however, may be passed over here, because Mr. Hunter (1883) has dealt with many of them in his interesting book on "The Woods and Forests of Perthshire."

The Scots pine is the most widely distributed of the conifers, and occurs both in the lowlands and the hills, following closely the distribution of the ling (*Calluna*). It seeds freely, and if undisturbed may form natural woods. Scots pine woods thrive best under conditions which may be summarised as follows:—

(1) Sandy plains at a low altitude. This is the case on Tentsmoor and the Sands of Barry. The natural dispersal of Scots pine and birch on Tentsmoor was the subject of a short paper by R. Smith (1900 A.). On the Sands of Barry considerable additions have recently been made to the area of coniferous woods near the national camp ground. Other features of the vegetation of these sandy plains will be dealt with later as part of the maritime zone.

(2) Peat bogs which have been partially drained. Montreathmont, the largest pine wood on the map, occupies an area of this kind. Numerous examples occur on the Sidlaws, on the plateau of East Fife and westwards by Thornton and Ladybank.

(3) Dry rocky crags and slopes along the valleys of most of the streams among the hills. The pine woods of the valleys form a zone at a higher altitude than the oak wood.

(4) Heather moors near the summits of portions of the Sidlaws and the foot-hills of the Grampians, and on the margin of the Grampian moorland. The large plantations at higher altitudes generally belong to this class, and if the larch woods are included, they form a zone of sub-alpine coniferous woods rising to an altitude of 1500 to 2000 feet. This is probably within the limit of the primitive upland pine forest as shown by the presence of buried timber in the peat; our observations, however,

[1] A useful contribution on "The Altitude of Forest Trees on the Cairngorm Mountains" is published by Mr. H. B. Watt (*Cairngorm Club Journal*, vol. iv., Jan. 1903).

are not numerous enough to allow of any definite conclusions on the upper limits of the original forest.

In the course of this survey the ground vegetation of many of the coniferous woods has been examined and recorded. The results show how much depends on the condition of the canopy, and this depends on the age of the trees and their distance from each other. In a close larch plantation on the Sidlaws on a summit (1212 feet), there is no underwood, and the herbaceous plants are few (e.g. *Potentilla sylvestris*, *Galium saxatile*, scattered grasses, and a few rushes in moist places; the ground is closely carpeted with mosses, especially *Hypnum Schreberi*, *Dicranum scoparium*, *Hylocomium squarrosum*, *Plagiothecium undulatum*, *Polytrichum* spp). The effect of less shade may be exemplified by another wood on the Sidlaws situated at a height of about 750 feet at the Long Loch of Lundie; an analysis of this wood (July 1898) was as follows:—

Trees: *Scots pine (*Pinus sylvestris*, L.). Dominant and in good condition.
*Spruce (*Picea excelsa*, Link.). Sub-dominant.
*Birch (*Betula alba* agg.). Scattered, but abundant.
*Rowan (*Pyrus Aucuparia*, Ehrh.). Scattered, but abundant.
*Larch (*Larix europæa*, DC.). Occasional.
*Sycamore (*Acer pseudoplatanus*, L.). Occasional.
*Ash (*Fraxinus excelsior*, L.). Few.
*Beech (*Fagus sylvatica*, L.). Very few.
Alder (*Alnus glutinosa*, Medic.). Near water.
* Seedlings of these were found.

Principal sub-associations of the ground vegetation:—

Blaeberry (*Vaccinium Myrtillus*, L.). Chief sub-association in shade not too dense.
Ling (*Calluna Erica*, DC.). Isolated patches; dominant in clearings.
Whin (*Ulex europæus*, L.). Occasional where shade slight.
Broom (*Cytisus scoparius*, Link.). Occasional where shade slight.
Rasp (*Rubus idæus*, L.) Especially with Birch and Rowan.
Anthoxanthum odoratum, L. Strongly social, large patches under trees.
Agrostis vulgaris, With. Strongly social, large patches under trees.
Deschampsia flexuosa, Tr. Occasional patches under trees.
Holcus mollis, L. Occasional patches under trees.
Deschampsia cæspitosa, Beauv. Occupying wet parts.
Juncus spp. Occupying wet parts.

The following are some of the scattered species:—

Viola Riviniana, Reich.
Polygala vulgaris, L.
Potentilla sylvestris, Neck.
Galium saxatile, L.
Cnicus palustris, Willd.
Pyrola media, Sw.
Trientalis europæa, L.
Rumex Acetosa, L.
Athyrium Filix-fœmina, Roth.
Lastræa Filix-mas, Presl.
L. dilatata, Presl.

The sub-associations become more conspicuous where the trees have been cleared. Whin and Broom occupy some clearings near the farmland on the southern edge of the wood and indicate a better soil in

this part. Wavy Hair grass (*Deschampsia flexuosa*) is the chief social species on most of the clearings. Ling claimed the clearings on the higher and drier part of the wood, and again on the steep rocky slopes on the northern or loch side. Birch and Rowan were confined to older clearings, and they may be regarded as a later stage of the hair grass and ling vegetation.

The forest of Caenlochan in Glen Isla, beyond the northern limits of the map is interesting, firstly as an example of a coniferous wood with a varied ground vegetation, and again as a wood lying at the highest limit of the woodland. Gardiner (1848) refers to the existence of a larch wood at this place. At the present time it is an extensive though thinly clad area of larch with a slight admixture of Scots pine (Fig. 6). A list

FIG. 6.—Caenlochan Forest at the head of Glen Isla. The lower edge is about 1500 feet altitude, the upper thinly wooded edge attains in places to 2500 feet.

(Reproduced by permission from photo by Messrs. J. Valentine and Sons, Ltd., Dundee.

of seventy species of flowering plants seen in this wood (August 1897) shows that the ground vegetation is derived from three sources. One portion of the flora comes from the neighbouring grassy moorland; another part from the adjoining peat-bogs of the Caenlochan plateau (3000 feet). A third part consists of woodland plants common in the woods at lower altitudes. In the shelter of this old forest these woodland plants find conditions suitable for their growth, while some of them reach a still higher altitude in the rocky ravines of streams which flow from the moor into the forest. For these woodland plants this is the highest, or one of the highest, stations in Forfar and Perth. The following were all observed in the larch wood between 1500 and rather more than 2000 feet; those marked (*) occur also in the ravine above 2500 feet, but probably do not exceed 3000 feet:—

ABUNDANT IN THE WOOD.

**Ranunculus acris*, L.
Viola Riviniana, Reich.
**Hypericum pulchrum*, L.
Spiræa Ulmaria, L.
**Potentilla sylvestris*, Neck.
Alchemilla vulgaris, L.
**Heracleum Sphondylium*, L.
**Scabiosa Succisa*, L.
**Campanula rotundifolia*, L.
Digitalis purpurea, L.
**Luzula erecta*, Desv.
**Deschampsia flexuosa*, Trin.
Lastrea Filix-mas, Presl.

SCATTERED IN THE WOOD

**Anemone nemorosa*, L.
**Trollius europæus*, L.
**Geranium sylvaticum*, L.
G. Robertianum, L.
Oxalis Acetosella, L.
**Vicia sylvatica*, L.
**V. sepium*, L.
**Lathyrus montanus*, Bernh.
Rubus idæus, L.
**Geum rivale*, L.
Fragaria vesca, L.
**Angelica sylvestris*, L.
Valeriana sambucifolia, Willd.
**Solidago Virgaurea*, L.
Primula acaulis, L.
Lysimachia nemorum, L.
Trientalis europæa, L.
Veronica Chamædrys, L.
Ajuga reptans, L.

THE MOORLAND.

Before considering the moorland of this particular area, it will be useful to summarise generally the present state of moorland survey. The chief types of vegetation on the sub-alpine moorlands of Edinburgh and Northern Perthshire (1900) indicated by colours are: (*a*) grass associations or hill pasture (Pa), heather associations (H), (*c*) mixtures of these (H Pa), and (*d*) some small areas of peat bogs where ling (*Calluna*) and cotton grass (*Eriophorum*) are dominant. The chief grass associations are indicated in the text, and are distinguished as pasture of the Basaltic hills, Silurian hills, Pentlands, Lawers, etc. In the surveys of Yorkshire and Westmorland it was found necessary to distinguish Grass Heath (*i.e.* grasses dominant, with heath plants as associates), from Pasture (*i.e.* grasses, etc., without heath plants). The latter being the better grazing ground retained the symbol Pa. The grass heath was then indicated in Yorkshire as H Pa (heath pasture), but Mr. Lewis (1904) adopted GH (grass heath).[1] The later surveys have not altered my brother's results in regard to heather associations, but they have extended our knowledge of the associations of the peat bog. Extensive areas of peat bog on the Pennines are covered with cotton grass, and are shown on the maps by colour and symbol (E). Some areas with cotton grass and ling equally dominant are indicated by EH, and are equivalent to the peat bogs shown in Edinburgh and Northern Perthshire. Mr. Lewis (1904) has

[1] The survey of Forfar and Fife had been so far carried out by my brother that this distinction could not be made without a new survey, which, in the circumstances, I cannot undertake. The grass vegetation is therefore indicated Pa, the same symbol used in the other Scottish maps. From my own observations I consider that the most of the grass moorland of Forfar and Fife is grass heath.

also found it necessary to distinguish by colour and symbol (S) extensive Sphagnum bogs in Westmorland.

The sub-Alpine moorlands (as known at present) may be tabulated thus:—

I. (A) Grasses, etc., without heath plants (Pa).
   (B) Grass heath (HPa in Yorkshire maps, GH in Westmorland) Several forms of this have been recognised, *e.g.*
      (a) *Festuca ovina* dominant.
      (b) *Nardus stricta* dominant.
      (c) *Molinia varia* dominant.

II. Mixtures of Grass Heath and Heather associations.

III. Heather associations (H).
   (a) Heath or dry heather moor (Heide) where ling (*Calluna Erica*) occurs with the purple bell heath (*Erica cinerea*) and associates which prefer dry soils with little peat.
   (b) Heather moor (Heide moor), thoroughly dominated by ling and associates preferring a slight depth of peat.

IV. Peat Bogs:
   (A) *Sphagnum* bog with scarcity of cotton grass or ling (S) in Westmorland.
   (B) Cotton grass (*Eriophorum*) moor (E) on the Pennines.
   (C) Peat bog with cotton grass and ling dominant; indicated by EH on the Pennines, and by HPt on the Scottish maps.

The moorland of Forfar and Fife lies mainly on the hills and mountains above the area of cultivation. Strathmore divides the moorlands into two groups. North of it, the Grampian moors rise to over 3000 feet on the plateau between Strathmore and the valley of the Dee, and the vegetation of the higher parts is distinctly Arctic. South of the great valley, the hills of Forfar and Fife belong to what Sir Archibald Geikie calls the Northern Heights of the Lowlands; in one part only do they attain 2000 feet, and the vegetation is almost wholly sub-Arctic. This division of the moors has a relationship to the maps of this survey already published; the Grampian area is essentially a continuation of the mountainous region of Northern Perthshire, while the Northern Heights are more closely related to the Pentlands and other hills of the Edinburgh district. On these grounds it is advisable to consider the two areas separately.

The Northern Heights of the Lowlands.—On the present maps these are really coast ranges, because their distribution determines to a great extent the contour of the coast-line. The greater part of the uplands belongs to the Ochil-Sidlaw range, itself the eastern part of a system of hills which extends across Scotland from the basin of the Clyde to the North Sea. The Ochils rise sharply from the Vale of Forth and rapidly attain a maximum elevation of over 2000 feet on Bencleuch and neighbouring hills outside the present maps. Eastwards, they decline towards Perth, although always a conspicuous range of hills. In the vicinity of Perth, the range forks, one part—the Sidlaws—forming the northern bank of the Tay valley, while the other lies along the

south side of the Earn and Tay. The Sidlaws, from Perth eastwards, gradually increase in height to a maximum elevation on Auchterhouse Hill (1399 feet) and neighbouring summits. From this, the range declines into a plateau with an altitude of from 500 to 600 feet in the Carmyllie district. As the coast is approached there is a further decline, but the range abuts on the North Sea as a series of bold cliffs, attaining in places to 300 feet. The geology of the Ochil-Sidlaw range is fairly uniform. The sandstones of the Old Red Sandstone period are broken through by andesitic lavas and volcanic tuffs (Geol. Survey) of the same period. In places these are again broken through by basalts and other intrusive rocks of a later age. The present Tay valley lies in a trough cut in a great anticlinal arch, so that the lava beds are tilted in opposite directions on the north and south of the valley, with the outcrops towards it (Fig. 7).[1]

The hills of Kinross and the central, southern, and eastern parts of Fife are different geologically. They consist of eruptive rocks which have broken through the limestones and other rocks of the Carboniferous

FIG. 7.—Section across the Firth of Tay.[2] *aa*, Lower Old Red Sandstone, covered by and alternating with *bb*, various volcanic rocks belonging to the same geological period. *c*, Upper Old Red Sandstone, lying on *a* unconformably. *ff*, Faults.

system. The chief range begins in the west on the Cleish Hills (Dumglow 1241 feet), and passes east and slightly north as the Lomonds (West Lomond, 1713 feet), and the upland cultivated plateau of East Fife. My brother had almost finished his examination of the Sidlaws and Ochils, and also the Cleish Hills. In a less degree was this the case with the other Fifeshire carboniferous area, and our opportunities have not allowed us to examine this part so fully as we should have wished. The vegetation of the moorland of the Northern Heights may be generally described as hill pasture or grass heath (Pa), with intrusion of heather under some soil-conditions (Pa H), and dominance of heather (H) in a few localities. A preliminary examination of the maps may give the impression that these three types of vegetation are erratic in their distribution. Careful examination has shown however that the edaphic or soil conditions have a marked influence. The Sidlaws and Ochils are more conveniently discussed separately from the hills lying in the Carboniferous area of Fife and Kinross.

---

[1] The figure is taken from Sir Archibald Geikie's *Scenery of Scotland*, where a description of the Tay valley and other parts of Forfar and Fife will be found. Messrs. B. N. Peach and J. Horne (1904) have given a sketch of the geology of the Tay Basin, which may be usefully referred to, especially in connection with the Northern Perthshire map.

[2] For the loan of this block we are indebted to the courtesy of Messrs. Macmillan and Co.

The Sidlaws and Ochils.

(A) *Grass Associations or Hill Pasture.*—The distribution of the chief associations of grasses, or grasses intermixed with heath plants, has been summarised in a description of a portion of the Sidlaws prepared by Robert Smith. If a section be taken through the Sidlaws of Perthshire from Strathmore to the Tay Valley (*e.g.* from Collace to Kinnaird) it will cut through the series of uptilted lava flows constituting the northern slope of the anticlinal arch in which the Tay flows from Perth downwards (see Figs. 7 and 8). The contour forms a long slope exposed to the north-west, and a series of steep slopes arranged stepwise, which are exposed to the south-east. On the northern slope there is more or less glacial débris, and where the soil moisture is greater, peat has formed or is still in process of formation. The soil is thus extremely variable, and on the whole poor and cold. Wheat is rarely found above 400 feet, and arable land ceases between 700 and 800 feet, although pasturing is carried on to the summit (994 feet at this part). The pasturage is chiefly grass heath with *Nardus stricta* as the dominant grass, hence these northern slopes can only be regarded as poor grazing grounds. The grazing restricts the growth of heather, which only becomes conspicuous in patches here and there where peat has formed, although it can be found in a dwarfed condition over most of the northern slopes. The vegetation may be analysed into three constituent elements according to the edaphic conditions. These, with some of their characteristic associates, are :—

(*a*) *Nardus stricta* dominant, with *Molinia varia* abundant, and in some places dominant; the soil is wet and peaty with underlying clay; situation in flat moist hollows.

Molinia varia, Schrank.
Agrostis vulgaris, With.
Juncus squarrosus, L.
J. effusus, L. (and other spp.)
Luzula campestris, DC.
Ranunculus acris, L.
Trifolium repens, L.
Rumex Acetosa, L.

(*b*) The ling (*Calluna Erica*) dominant; soil peaty on dry flat ridges. The grasses are scanty, and the heather association is that recognised as heath (see p. 14).

Festuca ovina, L.
Vaccinium Vitis-Idæa, L.
V. Myrtillus, L.
Potentilla sylvestris, Neck.
Galium saxatile, L.
Antennaria dioica, R. Br.
Carex Goodenowii, Gay.

(*c*) The ling dominant in the association of heather moor (see p. 14); in flat hollows of dry peat, liable to periodic flooding.

Erica Tetralix, L.
Nardus strica, L.
Juncus squarrosus, L.
Salix repens, L.
Polytrichum, spp.

These associations gradually changing one into the other indicate the scanty flora of the northern slopes. Turning now to the southern aspect of the Sidlaws; the general slope is much steeper, and the ground is

shaped into a system of dry knolls or broken terraces, with steep escarpments or steep banks of loose soil frequently riddled with rabbit burrows. The knolls and terraces are due to the emergence of volcanic rocks (chiefly andesitic lavas), which weather into a loose crumbling soil unsuited for the accumulation of humus. In the intervening depressions the soil is moister and contains more peaty matter. The vegetation of knoll and depression, apart from the farmland, is a grassy sward utilised for pasturage. That of the well-drained knolls has, however, features of its own.

The Whin or Gorse (*Ulex*) is a conspicuous plant of the dry knolls, while it is completely absent from the flat depressions. Frequently it has the form of low compact rounded shrubs from the grazing of sheep on it. Whin is most abundant at low elevations where the land has not been ploughed up; it becomes less abundant and less robust on the higher slopes, although it is not altogether absent at the summit (994 feet). On the northern slopes whin is rarely met with above 700 feet. The knolls are also covered with a close sward of grasses and other plants, except where the weathering rock is exposed. The following occurred on a whinny knoll of this kind about 700 feet:—

Ulex europæus, L.
Agrostis, spp.
Festuca, spp.
Anthoxanthum odoratum, L.
Viola Riviniana, Reich.
V. lutea, Huds.
Polygala vulgaris, L.
Linum catharticum, L.
Helianthemum Chamæcistus, Mill.
Lotus corniculatus, L.
Lathyrus montanus, Bernh.
Potentilla sylvestris, Neck.
Pimpinella Saxifraga, L.
Conopodium denudatum, Koch.
Galium saxatile, L.
Galium verum, L.
Bellis perennis, L.
Achillea Millefolium, L.
Hieracium Pilosella, L.
Campanula rotundifolia, L.
Vaccinium Myrtillus, L. (Dwarf.)
Calluna Erica, DC. Dwarf.
Veronica Chamædrys, L.
Euphrasia officinalis, L.
Thymus Serpyllum, Fr.
Teucrium Scorodonia, L.
Rumex Acetosella, L.

On the higher parts of the Sidlaws the knolls are frequently covered with a layer of humus formed by the decay of mosses, and here ling and its associates obtain a hold. Hence the green grassy knolls with whin of the lower slopes give way to heathy knolls with more or less heather, much grass, and some whin and whin seedlings. The depressions between the knolls at higher altitudes are covered with grasses, especially *Nardus stricta*, with more or less ling; that is, they have much the same vegetation as the northern slopes. On the lower southern slopes *Nardus* is sparingly present; the pasturage is closely grazed, and the grasses are difficult to distinguish, but *Anthoxanthum odoratum*, *Cynosurus cristatus*, with species of *Poa*, *Festuca*, and *Agrostis* are abundant. The terraces of the southern slopes are interrupted by water-worn dens or dells, the lower parts of which are frequently occupied by deciduous woods. Scattered trees may however be traced up to the summit of the range. The Bracken (*Pteris*) is not conspicuous on this part of the Sidlaws. It

usually occurs on the steep slopes of a "den," but is rare above 700 feet.

The special area just described is typical of the greater portion of the Sidlaws and Ochils. The long gentle northern slope and the steeper southern side is very general (Fig. 8). Referring to the range in 1813 the Rev. James Robertson (1813) says: "A poor kind of till covers all the north face of the Ochils from Dunblane to Abernethy, a tract of at least twenty miles." Referring to the Sidlaws, he says:

FIG. 8.—View from the Crags of Lundie towards the south-west along the Sidlaws. The nearer Pine woods are Pitcur and Ledcrieff, another occupies the summit of the low hill (800 feet). The higher summits, Ballo Hill (1028 feet) and King's Seat (1235 feet), show the long northern slope, and the steep terraced southern slopes. The trough in the foreground shows the steep grassy slope of the southern exposure, and the gentler heather-clad slope of the northern exposure.

(*Photo by Robert Smith.*)

"The north of most hills, where the soil is cold and deep; while upon the south it consists of a mould more light, generous, and dry. The grasses are consequently finer on the southern declination of the hills, and the coarser grasses on the northern sides." After a more detailed examination of the vegetation, our conclusions are much the same.

Although the greater part of the Ochils lies outside the present maps the range was almost all examined by my brother. The greenness of the Ochils impressed Pennant in 1769. This is due, generally speaking, to the greater dominance of the grass vegetation, and a more or less

complete suppression of the heather and its associates. The Ochils have long been used for pasturage, and Mr. Barclay points out that this may account for the suppression of the heather. The contours and the vegetation of the northern slopes differ from the southern slopes, as on the Sidlaws. On the northern side the lower slopes, up to about 1000 feet, are covered with a close sward of the better grasses, which provide good pasturage. The moor grass (*Nardus stricta*) increases with the altitude, and above 1000 feet is dominant, so that the pasturage is poorer. The southern aspect is terraced, steeper than the Sidlaws, and much eroded by streams which form numerous "dens" or glens. Above the limit of the farmland there is a grassy hill pasture which includes all the plants of the dry knolls of the Sidlaws (see p. 17). Whin is abundant up to about 600 feet. Above this, and extending up to from 1200 to 1500 feet, there is a well-marked zone of bracken, more or less interrupted by stretches of grass, with occasional clumps of whin. Dipping downwards into the upper limit of the bracken zone, and rising to the summits of the Ochils, there is an extensive summit pasture of moor grasses (*Nardus stricta* and *Molinia varia*). These two grasses tend to form distinct patches on the broad and undulating summit region, and with each come other plants, forming thus two sub-associations :—

In Moist Hollows	In Drier Places
Molinia varia, Schrank. Dominant.	*Nardus stricta*, L. Dominant.
Deschampsia caespitosa, Beauv.	*Deschampsia flexuosa*, Trin.
Juncus effusus, L. Dominant in places.	*Agrostis vulgaris*, With.
Carex flava, L.	*Sieglingia decumbens*, Bernh.
C. echinata, Murr.	*Juncus squarrosus*, L.
C. Goodenowii, J. Gay.	*Luzula campestris*, DC.
	L. erecta, Desv.
	Carex pilulifera, L.
	C. praecox Jacq.
	Ranunculus repens, L.
	Viola lutea, Huds.
	Trifolium repens, L.
	Potentilla sylvestris, Neck.
	Galium saxatile, L.
	G. verum, L.
	Campanula rotundifolia, L.
	Euphrasia officinalis, L.
	Thymus Serpyllum, L.

Ling and Blaeberry occur occasionally as subordinate species. The alpine species *Carex rigida*, Good., *Saxifraga stellaris*, L. and *Sax. hypnoides*, L. are recorded by Mr. Barclay from the summit pasture. The occurrence of the *Nardus* and *Molinia* pasture has already been noted in the Edinburgh district and Northern Perthshire. Comparative lists of the associates are given in the Yorkshire survey (Part I.), and Mr. Lewis (1904) has them in his paper. The close resemblance of the different lists in regard to associate species shows that the associations dominated by these two grasses are widely distributed in Britain, and are remarkably constant.

(B) *Heather vegetation of the Sidlaws.*—The associations in which the heather or ling (*Calluna*) is a dominant plant have already been summarised (see p. 14). The heath and heather moor are represented on many of the summits and summit ridges of the Sidlaws. The peat bog or moss moor is nowhere extensively developed, although locally it may occur in wet areas of small extent. Typical stretches of heather moor occur mainly on that part of the Sidlaws to the north of Dundee. On referring to a geological map, it will be seen that the heather area is closely coincident with considerable intrusions of basalt in this part of the Sidlaws. The andesitic and sandstone rocks of the Perthshire (or hill pasture) end of the Sidlaws here thin away to the north-east, and the hills are formed either of intruded basalt or sandstones thrown up on the flanks of these. The ling or heather (*Calluna Erica*) is characteristic of all the hill-tops of the basalt-sandstone area, *e.g.* Gallow Hill (1242 feet), Craigowl (1493 feet), and Auchterhouse Hill. It may be replaced by woods of conifers. It also occupies many of the ridges and slopes, descending even to the lower limits of the moorland. In the andesitic area, grassy hill pasture is more strongly developed, and the ling becomes subdominant. Thus, on Kinpurney—an andesitic hill—the ling is low and stunted and almost concealed by grasses, while the next hill to the east, half a mile away, is covered with heather moor, and consists chiefly of sandstone. The conditions which favour the dominance of heather vegetation are a poor, badly drained, sandy or volcanic soil on which peat may form. These conditions are attained most frequently on the sandstone or basaltic hills, but if soil-conditions are favourable, the heather associations may be fostered on almost any kind of subjacent rock. In Yorkshire on the carboniferous limestone, we have already indicated the occurrence of heather vegetation over a rock which is reputedly favourable to grass vegetation and adverse to heather. The heather is also favoured by periodic firing of the moors, but in the Sidlaws this operation has frequently assisted a rough *Nardus* grass heath to secure dominance. On looking over the heather area of the Sidlaws, one sees the water-courses distinctly defined as green belts of grasses and rushes. These limit to an important degree the distribution of the heather. The chief factor in the development of this green vegetation is the presence of moving water supplied by numerous springs emerging on the slopes; this brings food-material in solution and encourages the growth of grasses and rushes. The area of heather is also restricted by cultivation, and, although many parts are now abandoned for farmland, the heather does not obtain much hold until the food-materials are so far used up that the ground becomes unfit for pasturing.

Bracken and whin form associations within the heather area. The former occupies a distinct zone on the southern slopes. On Craigowl it rises at one point to 1400 feet on the dry stony slopes of grey slate-stone of the Old Red Sandstone period. Elsewhere it is well developed on dry steep parts from which trees have been cleared. On the northern slopes the bracken is poor, and is only found on the well-drained slopes of a valley or on recent wood-clearings. The whin in

its distribution follows the andesitic hills. On Kinpurney it reaches 1000 feet on the southern side, and is a conspicuous element of the vegetation on the lower slopes. Basaltic outcrops are here, as in the Perthshire Sidlaws, specially favourable to whin. It is the dominant plant on a whinstone ridge near the foot of Balluderon Hill, and repeatedly it has been recorded as abundant on the numerous detached basaltic knolls ("whinny knowes") which are left unploughed in this area.

(C) *Hills of the Carboniferous Area of Fife and Kinross.*—These include the Cleish Hills in the west, and are continued eastwards in Benarty, Bishop Hill, the Lomonds, and as an elevated plateau in East Fife, with other isolated hills of low altitude in East and South Fife. The main range is separated from the Ochil-Sidlaw system by a low trough in which lie Loch Leven and its streams in the centre, the upper waters of the Devon which flows westward, and the upper part of the River Eden which flows eastward. From some of the heights round this valley, long stretches of the green pastures of the Ochils can be seen, interrupted here and there by darker ridges where heather is more abundant. Patches of heather appear to be more numerous on the southern side of the valley, and this first impression is borne out by closer survey. The general type of the vegetation is a blending of grass heath and heather moor. The rounded summits are green and grassy, but wherever peat occurs the heather comes with it, and in many parts forms a close association.

The northern slopes of the hills of Central Fife are steep with long broken escarpments of bare basaltic crags, alternating with green slopes and patches of dark heather. The southern slopes are less steep, and form long stretches of rough pasture land. The vegetation of the northern side is the richer and more varied, and this suggests that the edaphic conditions are the more important factors, while the climatic conditions incident on northern or southern exposures are subordinate. Considerable attention was given to the relation between vegetation and soils on the Cleish Hills, and this survey is the basis of the following analysis, which however also applies to the other hills. Ascending from the northern side the moorland vegetation presents four aspects:—

(*a*) The rounded summits of the basaltic rocks, bright green with a close sward of closely cropped grass pasture. Sheep were observed to gather towards these knolls and rocks.

(*b*) Black basaltic crags weathering in a spheroidal manner, with dry crumbling ledges often undermined by rabbit burrows. The vegetation, except on the bare rock or screes, is chiefly grasses, but there is a considerable admixture of other plants. The following list was made at about 800 feet on a northern exposure:—

Deschampsia flexuosa, Trin.
Festuca ovina, L.
Agrostis, spp.
Anthoxanthum odoratum, L.
Viola Riviniana, Reich.
V. lutea, Huds.
Oxalis Acetosella, L.
Potentilla sylvestris, Neck.
Galium verum, L.
G. saxatile, L.
Campanula rotundifolia, L.
Veronica Chamædrys, L.
Rumex Acetosa, L.
Lomaria Spicant, Desv.

On similar crags with a southern exposure the number of species is considerably increased. Thus at 1000 feet on the crags of Dumglow exposed to the south-west, a list of forty species was made (August 1900). The following may be added to the above list as indicating the dry conditions and the comparative abundance of plant food which exist in these basaltic crags :—

Helianthemum Chamæcistus, Mill.
Geranium sanguineum, L.
Trifolium pratense, L.
Anthyllis Vulneraria, L.
Rosa spinosissima, L.
Pimpinella Saxifraga, L.
Scabiosa Succisa, L.
Veronica officinalis, L.
Thymus Serpyllum, Fr.
Teucrium Scorodonia, L.

A comparison of these with the florula of the basaltic knolls of the Sidlaws (see p. 17) shows a close agreement. This vegetation is also found again on the isolated hills of the lowlands of Fife (*e.g.* Largo Law and Hill of Beath). It is the type already described in the Edinburgh district (1900 B) as the pasture of the basaltic hills, and full lists of species are given in that paper.

(*c*) Gentle slopes with a soil made up of weathered basalt, numerous sandstone blocks and glacial boulder clay or till. The vegetation is one in which *Nardus* tends to be dominant. The change from the richer basaltic pasture to this poorer *Nardus* pasture can be seen on some of the slopes. The presence of boulder clay brings with it a badly drained peaty soil, and *Nardus* suppresses the richer grasses of the purely basaltic knolls. The *Nardus* pasture covers extensive areas, especially on the long gentle southern slopes of all the Fife hills. Its monotony is relieved either by the brighter green of the knolls and crags, or by darker patches where heather becomes more or less dominant. Our records show that the plants present are chiefly poorer grasses, while there is an almost total disappearance of the species of the dry rocky knolls. The vegetation is therefore very similar to that on the northern slopes of the Sidlaws (see p. 16).

(*d*) Heather. The three associations in which *Calluna* may be dominant (see p. 14) are represented. The dry heath may be found on dry ridges and steep slopes where the soil is sandy or contains much glacial débris. The heather moor occurs invariably (so far as observations were made) on glacial débris with sandstone blocks deposited on gentle slopes where some depth of peat has formed. The Sphagnum or moss-moor is well developed on the thick peat which covers the southern slopes of the Cleish Hills, but is only seen in small patches on the other hills of Fife.

The Sphagnum moor has already been described in the Edinburgh district, in which at Cobbinshaw there is a considerable extent. The Cleish Hills, however, gave further information on this association. These hills have gentle southern slopes generally covered with thick deposits of peat. The actual area of the existing peat moor is shown on the map, but much of the neighbouring pasturage and arable land is on reclaimed peat, and probably the whole area from Loch Glow to the Din Moss was formerly moorland peat bog. The chief factor in the

formation of this extent of peat is the presence of Loch Glow lying in a depression at 900 feet, and the Black Loch somewhat higher up. These are constant reservoirs, and the water overflowing from them and draining away slowly on the gentle slopes would furnish conditions extremely favourable to the formation of thick peat. That moisture is abundant at the present time is seen from the frequent occurrence of the bog-moss (*Sphagnum*). This moss is generally regarded as the chief plant in the earlier stages of peat formation, since it not only grows freely in wet places, but owing to its structure it acts as a sponge for accumulating water, and gives rise to thin layers of peat. The chief sub-associations of plants observed on the Cleish Hills are given here in the order from wet conditions to drier.

(*a*) Hair-moss (*Polytrichum commune* and other species) in wet places, where *Sphagnum* has previously given rise to a thin layer of peat.

(*b*) Sedge-bog:—*Scirpus cæspitosus* and several species of *Carex* in wet parts on shallow peat.

(*c*) *Scirpus cæspitosus* and *Molinia cærulea* dominant with sedges (*Carex* spp.) and grasses (*Nardus stricta* and *Deschampsia flexuosa*) as associates; situation on peat ridges with some drainage.

(*d*) *Scirpus cæspitosus* and *Calluna Erica* dominant, with *Erica Tetralix* as an abundant associate; situation, in wet hollows in peat.

(*e*) *Molinia cærulea* dominant on deep peat; the area occupied is however not extensive.

(*f*) *Calluna Erica* dominant, with the associates characteristic of the heather moor.

Taken as a whole the vegetation of the peat bogs of the Cleish Hills is that of a moss (or *Sphagnum*) moor with a strong dominance of *Calluna*. This latter condition, we suggest, is the result of drainage of the moor-edge (which is now more or less cultivated), and of the moor itself. From what has been observed in other districts, *Calluna* is not present in quantity on a wet peat bog, and where it does occur over deep peat, there is usually drainage to some extent. A system of drainage is one of the first operations in converting a wet peat bog covered with cotton grass into a heather moor.

From the Cleish Hills a series of peat bogs can be traced eastwards along the depression of Central Fife. These include Moss Morran (473 feet), about five miles south-east of the Cleish Hills, the Star Moss (near Markinch) and other smaller mosses which are now reclaimed as farm land or planted with coniferous woods. The condition and depth of the peat in Moss Morran was demonstrated in August 1901. A coal pit air-shaft was being made by excavation upwards from workings underneath; at about 24 feet below the surface, on emerging from the rock into the peat, the shaft and workings were inundated by a stream of semi-liquid peat, in which several men were buried. This accident served to confirm the conditions of the peat indicated by a survey of the Moss made in August 1897, and might have been predicted, because the vegetation is that of a peat bog containing a large amount of water.

(*To be continued.*)

THE SCOTTISH NATIONAL ANTARCTIC EXPEDITION.

SECOND ANTARCTIC VOYAGE OF THE "SCOTIA."[1]

By J. H. Harvey Pirie, B.Sc., M.B., and
R. N. Rudmose Brown, B.Sc.

(With Map and Illustrations.)

It is very satisfactory to be able to report that, although the Scottish National Antarctic Expedition has returned, it has been found possible to continue part of the work begun by that expedition in the Antarctic

Fig. 1.—Omond House, South Orkneys.

regions. The Argentine Government, during the stay of the *Scotia* at Buenos Ayres, agreed with Mr. Bruce to take over and continue the meteorological and magnetical observatory at Omond House, Scotia Bay, South Orkneys, which was built and set in working order during the winter that the Scottish Expedition spent at these islands. The Argentine Government had previously taken a very conspicuous part in the rescue of the recent Swedish Antarctic Expedition, and by now undertaking the responsibility of this Antarctic observatory, is showing itself keenly alive to the interests of science. The arrangement come

[1] Cf. this *Magazine*, vol. xx. pp. 57 and 113. We regret that, owing to ill-health, Mr. W. S. Bruce has been himself unable to complete the account of the *Scotia's* work in the Antarctic, and this task has therefore been delegated to members of his staff.—Ed. *S.G.M.*

Photograph by W. Crooke, Edinburgh.

Wm. S. Bruce.

to was in great measure due to Mr. W. H. Haggard, British Minister to the Argentine Republic, Mr. W. G. Davis, of the Argentine Meteorological Office, and Dr. Francisco Moreno, of the La Plata Museum.

On January 21, 1904, the *Scotia* left Buenos Ayres for the south on her second journey. In addition to her own staff, there were on board three Argentine scientists, Messrs. E. Szmula, L. H. Valette, and H. Acuña, for the meteorological observatory in Scotia Bay. On her way the *Scotia* called at Port Stanley, Falkland Islands, where the remainder of the expedition's stores were taken on board, and finally on February 9 she left for the South Orkneys.

After a quick passage, during which no ice was met with, the South Orkneys were reached on February 14.

The effect of the summer temperatures was very noticeable in the amount of rock and beach now exposed in various parts of the islands.

Fig. 2.—Saddle Island, South Orkneys.

Additional coal and provisions were landed, a complete wooden roof was put on the house, and a large lean-to shed built. On February 22 the Argentine party was left under the leadership of Mr. R. C. Mossman, who had consented to remain for a further period of twelve months. William Smith, the *Scotia's* cook, also agreed to stay.

This season there was an almost complete absence of pack in the vicinity of the islands, and on leaving the Orkneys a south-easterly course was steered with the object of cutting between our two tracks of the previous year. With the exception of bergs, no ice was met with till near the Antarctic Circle, where a slight detour had to be made to round some pack-ice.

In the beginning of March the *Scotia* crossed her old track of the previous year, and a few days after exceeded her previous southern record, and also Ross's furthest south in 1843. Skirting more or less open pack to the westward for about the last 300 miles, we had as yet met no obstacle to our southern progress, whereas the previous year we found impenetrable pack in this region.

In 72° 18′ S., 17° 59′ W., we obtained a sounding of 1131 fathoms. This was a sudden shallowing, as up till now the depths had all been over 2600. At the same time land was reported ahead. Steaming towards this we found a lofty ice-barrier stretching in a north-easterly and south-westerly direction, effectually barring further progress to the south. Close heavy pack prevented a nearer approach than two miles. This barrier was traced for a distance of 150 miles to the south-west. In 73° 30′ S., 21° 30′ W., a depth of 159 fathoms was got, the barrier being then two and a half miles off.

Early on the morning of the 7th the *Scotia* was caught in a north-easterly blizzard, and despite all efforts to get free, was beset in slush and heavy pack. During the following day pressure from the driving pack became great, the ice at times piling up against the ship's sides, and, as we found afterwards, going right under her, with the result that the ship was lifted bodily out of the water some four feet. It was doubtless in consequence of this that the *Scotia* suffered no injury from the tremendous pressure.

At the end of two days the gale abated. We then found that we had been driven into a bight of the ice barrier. This was in 74° 1′ S., 22° 0′ W., and the depth here was 161 fathoms—two miles off the barrier. There was no open water in sight, and the temperatures down to zero which now set in soon froze up the pack. For four days there was no change in the weather, and owing to the lateness of the season, which seemed to preclude the possibility of our being liberated, we began to make preparations for the winter. During these days collections of the marine fauna were made by means of traps, and a number of emperor penguins, which were here extraordinarily abundant, were secured for the double purpose of specimens and food in the event of our having to winter. Giant petrels (*Ossifraga gigantea*), Skuas (*Megalestris antarctica*), and Terns (*Sterna hirundinacea*), Antarctic petrels (*Thalassœca antarctica*), and Snowy petrels (*Pagodroma nivea*), were present in large numbers, and some seals (*Lobodon carcinophagus* and *Leptonychotes weddelli*) were seen.

On March 13 a change took place, the pack began to break up under the influence of a gentle south-west wind, but the *Scotia* remained firmly fixed in a large floe. After futile efforts to break the ice by tonite, gunpowder, and other means, the floe gave way of its own accord, and the ship was once more afloat.

But during the succeeding twenty-four hours the ice remained tightly packed, and little progress was made, and it seemed quite probable that the ship would be again beset. Fortunately, however, the ice soon slackened again in a way which it often does without any apparent reason, and the *Scotia* was skilfully navigated to the edge of the pack, though not without great difficulty. This newly discovered part of the Antarctic Continent has been named "Coats Land," after Mr. James Coats, jun., and Major Andrew Coats, the two chief subscribers to the expedition.

In this connection we quote the words of Mr. Bruce:—"I have been asked by several if I am sure that this great ice-barrier was really part

Fig. 3.—Coats Land.

of the Antarctic Continent. I have no hesitation in saying 'yes,' and my reasons are these: All our soundings between 60° to 70° S. were 2500 to 2700 fathoms. In 72° S. they shoaled to about 2300, fifty miles from the barrier. Thirty-five miles from the barrier they shoaled to 1400 and 1200 fathoms, and two miles from the barrier to 160 fathoms. This alone should answer the question in the way which I have done. Secondly, from the vertical cliff of ice 100 to 150 feet in height which bordered the ocean, the ice rose high inland in undulating slopes and faded away in height and distance into the sky. It was impossible to estimate the height of this field of ice—the true inland ice of Antarctica—but probably it was many thousands of feet. Thirdly, seals and birds, which up till now had become few in numbers, were seen in myriads—penguins, especially emperors, many petrels, and terns swarming in every direction—the inhabitants of the beaches and rocky cliffs of some actual land not very far distant."

It was now the end of the Antarctic summer, and our somewhat unexpected escape from the ice was sufficient warning that it would be unwise at that season to force the *Scotia* again into the pack. We therefore turned north-eastward towards the "Ross Deep," an examination of which was part of the programme of the expedition. The water began to rapidly deepen to 2000 fathoms and over until after a few days, when, as the sea seemed open in that direction, we set a somewhat more easterly course, which soon brought us into rapidly shoaling water, until in 71° 32′ S., 17° 15′ W., it was 1221 fathoms, which showed we were getting to the continental shelf. At this point, however, pack again began to be met with, and the *Scotia* was therefore turned back on her former course to the north-east. It is worthy of note that a trawling we took in 1410 fathoms in 71° 22′ S., 16° 34′ W., resulted in one of the richest hauls we had in Antarctic waters, no less than some sixty species of animals being obtained.

On March 23 a sounding of 2660 fathoms was obtained within one mile of Ross's reported sounding of 4000 *fathoms no bottom*, and so after sixty years this sounding, and with it the hypothetical contours of the South Atlantic based on it, have been obliterated from the map. This, however, implies no disparagement of the splendid work of Ross in his exploration of the Antarctic. Doubtless his error was due to the inadequate sounding apparatus which was then at the disposal of oceanographers, and to the existence of a strong undercurrent which we discovered in this region. This undercurrent was a source of great trouble, and on two occasions prevented the trawl from reaching the bottom, while on a third occasion we had to pay out about 1000 extra fathoms of cable before this was effected. After this the *Scotia* turned northward with the intention of sailing along the meridian of 10° W., and taking a line of soundings and other observations up to Gough Island. In this part of the South Atlantic Ocean there were no previous records, but deep water of 3000 fathoms was hypothetically charted.

Up to about the latitude of 54° S. icebergs were frequently met with, but on the whole the weather was fine and the seas calm, so that sounding and trawling were carried on with little difficulty and sets of serial

FIG. 4.—Glen on Gough Island.

temperatures obtained. North of this latitude we got into very stormy weather. Constant gales from the NW. and NNW. accompanied by heavy seas made progress very slow, and only permitted sounding to be carried on at great sacrifice of gear. However, a fairly complete set of soundings were taken, with the result that we discovered comparatively shallow water, under 2000 fathoms, north of 52° S. This shows an extension of the Mid-Atlantic ridge to the south of the Tristan d'Acunha group. From 58° S. to 48° the bottom was diatom ooze and hard ground; in 46° and 41° S. samples of globigerina ooze were brought up.

The *Scotia* behaved splendidly throughout all these weeks of bad weather, and beyond the loss of a quarter boat swept away during a

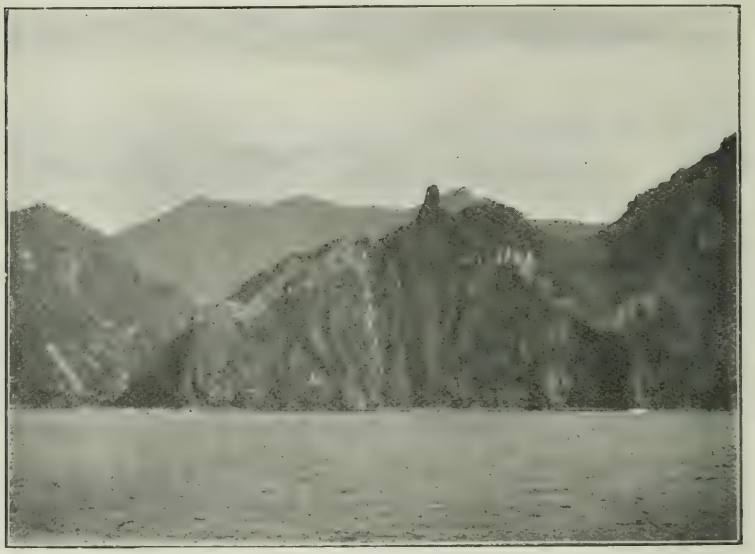


Fig. 5.—Cliffs of Gough Island, showing hanging valley.

severe gale, sustained no damage. She proved herself as satisfactory a sea boat as she had proved herself an ice boat in the Far South.

On April 21 Gough Island was sighted during the first watch. Next morning we steamed along the lee of the island, but so heavy a sea was running that landing was out of the question. The following day the sea had moderated, and we succeeded in landing at what is apparently the only spot on the island whence access to the interior can be obtained. In all other places the island meets the sea in more or less perpendicular precipices with only a small strip of beach at low tide.

At the place where we landed a mountain torrent comes down a picturesque glen from the interior. Vegetation was very plentiful; the whole island indeed is clothed in green. Tussock grass (*Spartina arundinacea*) and a small stunted tree (*Phylica nitida*) both grow in abundance even on the more exposed places. Ferns and mosses are

luxuriant beside the numerous waterfalls and along the banks of the stream. A number of birds were seen, including finches and a water-hen; a few insects were also found. In its general aspects both the fauna and flora resemble those of Tristan d'Acunha, but without doubt include several new species: two species of birds new to science are now being described. After four hours ashore we returned to the ship with collections which were of exceptional interest as being the first scientific collections ever obtained there. Ruins of huts were found near our landing place. These, we afterwards found at Cape Town, had been inhabited by sealers who had spent some months in the island.

The next day we spent in dredging and collecting birds off the land, and left at nightfall for Cape Town. Fine weather and fair winds were

Fig. 6.—Narrow Peninsula on north coast of Laurie Island.

experienced, so that we got several soundings taken on our course between the parallels of 39° S. and 40° S., finally reaching Table Bay on the evening of May 5, 1904.

Two weeks later the Scottish Expedition left for home, calling *en route* at Saldanha Bay, St. Helena, Ascension, and Fayal (Azores), at each of which places a stay of two or three days was made. At Cape Town and all other ports of call the expedition was warmly welcomed, and much interest shown in our work. At Ascension we had the good fortune to meet with H.M.S. *Beagle*, whose captain and officers had treated us with so much kindness at the Falkland Islands on our return from the Antarctic in December 1903. On our arrival at the Azores we met S.M.S. *Gazelle*, of the Imperial German Navy, on the point of departure for Europe, and her captain very considerately offered to take home a mail for us. We were glad to take advantage of this opportunity, as otherwise letters could not have reached home before us.

After touching at Kingstown on the way, the *Scotia* reached the Clyde on July 31, and was accorded a magnificent reception at Millport.

To sum up: the chief scientific results of the *Scotia's* voyage are:—

(1) In the Weddell Sea a large number of soundings and the finding of a southern limit at Coats Land, show this sea to be considerably less extensive both in area and depth than was previously supposed. Numerous observations on the temperature and salinity of the water have been taken at all depths, samples of the bottom deposits got, and a zoological collection gathered which embraces a large number of birds in addition to seals, fish, and representatives of almost every class

FIG. 7.—Cape Dundas, eastern extremity of Laurie Island.

of the invertebrates, from the surface waters, from intermediate depths, and, above all, from the bottom of the ocean. Systematic plankton collections were also made.

(2) At the South Orkneys materials were collected for a detailed map of Laurie Island (see Figs. 6, 7, and 8), which we hope to have ready for publication very soon; a continuous hourly meteorological record was kept for eleven months, a record which is still being kept, and which is supplemented by similar observations taken by the *Scotia* all the time she was at sea; magnetic observations were made, which this year will see still further extended under Argentine auspices; the botany and geology was investigated, and an extremely rich shallow-water fauna collected, in addition to numerous specimens of the seals and of the birds of the locality, with their eggs.

(3) In the South Atlantic a somewhat deeper channel has been demonstrated between the Falkland Islands and the South Orkneys than was previously supposed to exist.

Further to the east, the ocean's contours have been materially changed by the discovery of a large southern extension of the Mid-Atlantic ridge to the south of Gough Island. Physical and biological work has been carried out in a hitherto entirely uninvestigated ocean; and on Gough Island a small but representative collection of the fauna, flora, and geology has been made for the first time.

But the South Atlantic is large, and there still remains much to do. Between the Tristan d'Acunha group and the South Georgia the ocean is, from a scientific point of view, absolutely unknown. To the south

FIG. 8.—Glacier at head of bay, north coast of Laurie Island.

and east of South Georgia much information is wanted with regard to the ocean depths, and of South Georgia itself, despite the recent work of the Swedish Expedition, comparatively little is yet known. The South Sandwich group remains entirely unexplored. The survey of the South Orkneys begun by this expedition requires to be continued, especially in the western half of the group. Exploration of Antarctic lands in this region offers what is perhaps the finest piece of pioneer work in geography remaining to be done. From Coats Land eastwards to Enderby Land, through 60° of longitude, the position of the coast-line is entirely unknown; while to the westward the map shows another great blank area intervening ere the fringe of the Antarctic is again reached in Graham Land. It is to be hoped that our knowledge of this region will not long remain in this partial condition, but that the work commenced by Mr. Bruce will be continued in the near future.

SUMMER WORK IN THE SOUTH ORKNEYS.

By J. H. Harvey Pirie, B.Sc., M.B.

During the absence of the *Scotia* the hourly meteorological observations and magnetic work were carried on without intermission. Tow-netting, boat-dredging, and trapping were done whenever opportunity offered, but no great additions were made to the fauna collected during the winter.

Bird life was very abundant, and, the nesting season being in full swing, extremely interesting. Two new birds were recorded for the locality:—(1) A yellow-crested penguin, probably *Catarrhactes chrysolophus* (Macaroni penguin), of which four specimens were got. Two were immature birds, got on January 29 and February 6, so it is possible that the species occasionally breeds in the South Orkneys, but on the other hand the bird may have come from the Falkland Islands or South Georgia. In the latter locality this bird is known to be an early

Fig. 9.—Giant Petrel, South Orkneys.

breeder, laying commencing in the last days of October, but even granting this, 500 miles of rough open sea would be a long journey for such a young bird to make. (2) A small petrel (*Oceanites sp.*) of which one specimen only was caught.

The eggs of the well-known Cape Pigeon (*Daption capensis*) were got for the first time. Although known to breed on South Georgia and Kerguelen, the eggs had never hitherto been got. The nest consists of a few small angular fragments of stone on bare ledges of the cliffs. A single egg is laid, pure white, and large in size compared with the bird. Egg-collecting is rather a disagreeable business, as the birds, instead of flying off when approached, remain on the egg and try to warn off the intruder by ejecting at him a noxious, evil-smelling reddish fluid, the partially digested Euphausiae on which they feed. Several of the other petrels have a similar nasty habit—Snowy petrels, Wilson's storm petrels, and, though less markedly, the Giant petrels.

Before laying, the Cape Pigeon sits close on the nest for about a month: the first eggs were got on December 2, and until two or three

days before this the birds had disappeared from the islands altogether for about ten days. The young were not hatched until January 13, giving an incubation period of six weeks.

On this date the first Wilson petrel eggs were got, and they had not hatched any young when we left the Orkneys on February 21. These birds seem habitually to lay too late; for, in the crevices, along with the single fresh egg, two or even three unhatched eggs of previous seasons and occasional dead nestlings were almost always to be found. A more feasible explanation would be that there had been a succession of cold summers, which certainly was the case in 1902-3, whatever it may have been previous to that. Weddell seals were very numerous: over a hundred could often be counted lying on the small raised beach on the west side of Scotia Bay.

Sea leopards came ashore fairly often, but very few Lobodons and only a single Ross seal were seen.

Fig. 10.—Weddell Seal.

The general weather of December, as will be seen from Mr. Mossman's appended meteorological abstract, was not of the character one usually associates with midsummer.

The amount of cloud, for example, 9·3, was greater than in any month except March, while the number of hours of snowfall (212) was in excess of every month except August with 218. As regards sunshine, the total for the month, viz. 73 hours, was actually less than that recorded during September. There was also much drift, and even as late as the 21st the appearance was about as wintry as during any of the six months preceding.

In January the weather showed a considerable improvement on that of December, although there was more cloud and less sunshine. Drift was almost wholly absent, and light winds prevailed. Kite flights for the purpose of investigating the meteorology of higher strata of the atmosphere were tried on four different days during the summer, but unsuccessfully. The kite either would not rise owing to the lightness of the wind, or else carried away during squalls. The infrequency of the

flights is to be regretted, but there were very few days on which they could be attempted. Thus, in December, on thirteen days the wind was too light—the maximum hourly air movement being under thirteen miles per hour. On seven days the wind was certainly too strong, and on some of the remainder pack ice was in the bay, which would have made it impossible to recover the kite in the event of it breaking loose, an accident that happened on three occasions.

Meteorological Abstract for December (South Orkneys).

Mean Barometric Pressure (corrected to 32° and mean sea level).—29·201 inches; maximum, 29·866 inches on 14th; minimum, 28·445 inches on 21st; monthly range, 1·421 inches.

Mean Temperature.—31°·5; mean of maxima, 34°·0; mean of minima, 29°·4; mean daily range, 4°·6; mean variability, 0°·93; highest observed, 40°·8 on 18th; lowest observed, 25°·4 on 3rd; monthly range, 15°·4.

Humidity.—Mean wet bulb, 30°·6; mean relative humidity, 88; mean vapour pressure, 0·156 inch.

Mean Wind Force.—1·27 (scale 0-12); corresponding velocity in miles per hour, from anemometer, 9·0. Wind blew from N. 7 hours, N. × E. 2, NNE. 3, NE. × N. 2, NE. 4, NE. × E. 6, ENE. 10, E. × N. 7, E. 20, E. × S. 8, ESE. 21, SE. × E. 17, SE. 73, SE. × S. 38, SSE. 20, S. × E. 4, S. 0, S. × W. 0, SSW. 0, SW. × S. 0, SW. 2, SW × W. 0, WSW. 3, W. × S. 0, W. 20, W. × N. 11, WNW. 69, NW. × W. 61, NW. 205, NW. × N. 47, NNW. 21, N. × W. 7, and was calm or variable during 56 hours.

Mean amount of cloud (overcast sky or fog = 100) 93; number of hours overcast, 591; number of hours cloudless, 2.

Total bright sunshine, 73·3 hours; sunless days, 6; maximum on one day, 8·9 hours on 18th.

Number of hours during which the following phenomena were observed:—

Snow,	212	Silver thaw,	2
Snow-drifting,	109	Solar halo,	1
Hail,	3	Lunar halo,	0
Rain,	28	Squally,	101
Sleet,	6	Haze,	26
Mist,	50		

List of Soundings taken on the "Scotia's" Second Voyage.

		Depth in fathoms.
62° 49′ S.	38° 12′ W.	2394 (no bottom).
64° 38′ S.	35° 13′ W.	2690
65° 59′ S.	33° 06′ W.	2625
66° 14′ S.	31° 18′ W.	2630
66° 43′ S.	27° 55′ W.	2685
72° 18′ S	17° 59′ W.	1131
73° 30′ S.	21° 30′ W.	159
74° 01′ S.	22° 00′ W.	161
73° 09′ S.	23° 53′ W.	1950
71° 50′ S.	23° 30′ W.	2102
71° 28′ S.	22° 32′ W.	2338

		Depth in fathoms.
71° 22′ S.	18° 15′ W.	2370
71° 22′ S.	16° 34′ W.	1410
71° 32′ S.	17° 15′ W.	1221
69° 33′ S.	15° 19′ W.	2620
68° 32′ S.	10° 52′ W.	2487
68° 32′ S.	12° 49′ W.	2660
66° 57′ S.	11° 13′ W.	2715
61° 21′ S.	13° 02′ W.	2764
56° 58′ S.	10° 03′ W.	2518
55° 08′ S.	9° 50′ W.	2270
52° 33′ S.	9° 47′ W.	1766 and 1810
51° 07′ S.	9° 31′ W.	2103
48° 00′ S.	9° 50′ W.	1332
48° 06′ S.	10° 06′ W.	1742
45° 56′ S.	10° 05′ W.	1799
41° 30′ S.	9° 55′ W.	1998
Three miles ESE. of Gough Island		1322
39° 58′ S.	8° 36′ W.	1807
40° 33′ S.	0° 4′ 30″ E.	2543 (no bottom).
40° 08′ S.	1° 50′ E.	2645
39° 27′ S.	5° 17′ E.	2900
39° 25′ S.	10° 45′ E.	2625

LETTERS FROM MOROCCO.

TANGIERS.[1]

(*Continued from page* 649.)

THE native population of Tangiers is very composite, members of nearly all the tribes of the interior being attracted to the town in search of wealth or commerce, as in all the great seaports. The principal native element here is not, as at Fez and Tetuan, descended from the Moors of Andalusia, chased from Spain in the sixteenth century. The latter were badly received by the inhabitants of the town, who belong for the most part to the same races as now inhabit the surrounding country, the Fah'c and Anjera. More civilised than their country neighbours by contact with the Europeans, and softened by the enervating life of Mussulman towns, they have easy and gentle manners. The well-to-do folk are merchants, the others live by small trades, or are mule and donkey keepers; others, again, enter the service of the Europeans, and make excellent cooks and butlers.

The ordinary native dress of Tangiers is much less picturesque than that of Algiers or Tunis, and consists merely of a *djellaba*, a sort of loose

[1] Our attention has been called to an error in the December *Magazine*, p. 647, line 8, where it is stated that the sea at Tangiers retreats *30-40 kilometres* at low tide. This statement, inadvertently passed in proof, is obviously due to a slip of the pen, but in the absence of the author, who is abroad, the exact intention cannot be made out.

coat hanging barely to the knees, with short sleeves. This is made of a coarse brown or grey cloth, and occasionally embroidered in coloured silks along the seams. The headdress is a red *chechia* or turban, with camel's-hair cord or white stuff twisted round it.

Most public offices are filled by descendants of men sent from Fez by the Sultan, who were themselves descendants of the Andalusian Moors. These have formed a sort of caste by themselves which furnishes all the Moroccan towns with officials, more or less relatively intelligent and capable of holding intercourse with the Europeans. These people, with their grave, distinguished air, delicate features, and gentle manners, are pleasant on first acquaintance. Unfortunately, their want of education or of knowledge of the world beyond their narrow family circles and the unenlightened court of the Sultan, makes it difficult for them to understand any of the subtleties of European civilisation or administration, and hence, from want of understanding, they refuse as much as possible to admit any innovations.

Besides this sedentary population, composed of soldiers, officials, independent gentlefolk, merchants, and workpeople—about ten thousand Mussulmans in all—there is a floating population of Moroccans gathered from various parts of the country. The big *sokko*, or market, is busy every day, but it is especially on Thursdays and Sundays that the country people come in. About five thousand of these peasants arrive from Fah'c and Anjera, Arabised-Berbers who have lost their old dialect, but who maintain the manners and customs of all the inhabitants of the Riff. All are of a quasi-European type, like the Kabyles and Shawias of the Aures mountains in Algeria, with light eyes and chestnut hair and beard. Very fair when young, they become rapidly bronzed, as they wear no protection to the head, neither the immense hat of the Algerian *khammas* (field-workers), nor a turban, nor even a simple cap. They shave the head, leaving only a tuft of hair, which they pleat and leave hanging down the neck. Some few twist a camel's-hair cord round the head. Arms, legs, and neck bare, they wear nothing but the ungraceful *djellaba*, without sleeves. They are, however, nearly all provided with a Martini, Gras, Remington, or Mauser rifle, and wander through the town fully armed, in spite of the Pasha's prohibition. Although brusque, and said to be savage and dangerous, they enter easily into conversation, and a few judiciously distributed tips render easy many apparently dangerous excursions. They have only one desire, namely, that the French (or any other nation) should not come to conquer their beloved mountains, an enterprise which certainly no one would feel inclined to attempt, considering the arid and sterile nature of the country. This mountainous region round Tangiers is one of the least productive parts of Morocco.

One finds also in Tangiers colonies of natives from different parts of the interior, each devoted to a particular trade, each trade having a *mok'addem* or chief, who is responsible to the Pasha for his followers. There are thus Riffains, Jebala, people of the Sûs, Draai, negroes from the extreme south, Berbers, and Merrakchi.

There is also the Jewish population, which, as in the other Moroccan

ports, is composed of descendants of the Jews expelled from Spain some centuries ago. They are more interesting than the Jewish tribes of the interior, who have fallen to the lowest depths of degradation, more savage and sectarian than the Berbers. In Tangiers some of the Jews still retain the costume formerly imposed on them by the Moors, the grey coat with a belt and black turban. But most begin to wear European dress now. They are allowed full liberty, and are no longer compelled to live in the *mellah* or Ghetto. They are merchants, cashiers, book-keepers, commercial travellers, employees in merchant and banking houses. It is right to notice their scrupulous honesty in business affairs, their faithful observation of promises made, and also their politeness towards Europeans. Their manners are frank and cheerful, very different from the servile demeanour of many of their co-religionists elsewhere. All speak Spanish perfectly, and use that language among themselves.

There are, of course, many untrustworthy business agents and brokers of whom one must beware, but these are of all races and all religions. It is to the influence and intervention of the Europeans that is due the liberty and toleration accorded to the Tangiers Jews, and this fact alone is sufficient to lead one to hope for the gradual but sure extension of European civilisation in Morocco.

Of the population of 40,000 inhabitants, about 20,000 are Mussulman, and 12,000 Jews. There remain, therefore, 8000 Europeans. Two or three years ago there were only about fifty French, but that number has rapidly increased, and now there are over 400 French and Algerians established in Tangiers. These are, besides the members of the Legation, merchants, employees in shops and banks, etc., all of whom meet at leisure hours in the different cafés of the smaller *sokko* to discuss the topics of the day.

The Spaniards, from 6000 to 7000 in number, naturally constitute the predominant European element of the population, and an unenlightened traveller might easily imagine Tangiers to be a Spanish possession. Castillian is spoken constantly and nearly universally. In the shops, post-offices, shipping agencies, even with the natives (if one is ignorant of Arabic) one must speak Spanish. However, some Moroccans, and especially some of the Jews, who see the way the wind blows, try more and more to speak French. It is naturally the proximity to Spain which attracts this numerous population, which is encouraged by the Spanish Legation. In the eighteenth century, the Vatican granted to the Spanish Franciscans the sole right to celebrate the rites of the Catholic Church in Morocco, and in Tangiers in particular. They have there a church and a monastery, where priests and so-called lay brothers live together, all dressed alike in brown robe, sandals on feet, and generally bare-headed. They keep up in Tangiers a soup-kitchen, a hospital and school, the latter crowded with young Spaniards. In theory, the Franciscans are supposed to teach French in their school, but this rule is not fulfilled in practice. There is only a small private French school, which is in very low water; but, on the other hand, there is a Franco-Arab school where a French education is given to a certain number of Arab and

Moroccan children. The Franciscans insist rigidly on their rights. Thus they recently prevented a French priest in attendance on a private individual from saying mass in the house of the latter, and threatened him with all the thunders of the Vatican in case of disobedience. Many other instances of their singular manner of interpreting Christian charity are related. They do not attempt any proselytising among the Moroccans —which would indeed be useless—but it is said that they use all their influence against the French.

The lay element of the Spanish population is composed of honest workers, who are small tradesmen, hairdressers, bakers, masons and carpenters in the town; horse and mule-keepers or market gardeners in the country. They are a hard-working, industrious set of people, mostly from Andalusia and the south of Spain, and constitute the most reliable part of the working population of the country. It is upon these people that France must count in her proposed development of Morocco. There is also, unfortunately, a large number of good-for-nothings, escaped convicts, deserters, and anarchists, who give their honest compatriots much trouble and with whom severe measures will have to be taken.

The English colony consists of the winter residents and of numerous tourists who inhabit the villas and hotels surrounding Tangiers. Beyond these, there are only the members of the legation and consulate, post-office employees, a few merchants, and the missionaries sent out by the North African Mission. As in Algeria and Tunis, the missionaries, while doing some charitable work, try, without much success, to convert the natives. The Bibles and tracts which they distribute serve for the most part only as waste paper!

There are few Germans in Tangiers, and a still smaller number of Belgians, Portuguese, Italians, and Austrians; the latest statistics mention only one American, Mr. Perdicaris.

Such is the composition of the European population, small as yet in number; but it is owing to this population that Tangiers has not remained an entirely Moorish town, closed to all the benefits of civilisation. It is to a Spanish company that is due the introduction of electric light and the telephone. As regards sanitary affairs and the precautions to be taken on the return of the pilgrims from Mecca, these are arranged by the Diplomatic Corps, assembled as Sanitary Council!

The hour of sunset is announced every evening by a blare of trumpets from the soldiers, the night falls rapidly, and gradually the streets and market-places empty themselves of the busy throng which has filled them all day long. The cafés of the little *sokko* become animated and gay with their evening customers. In the middle of this square a number of Arab women instal themselves every evening with piles of little round loaves to sell. These groups, lighted each by a single candle, are very quaint and curious; it is said the custom is a very ancient one, dating back for many centuries. By ten o'clock all the streets are deserted, shops shut, shutters closed, all the world is asleep. Three Spanish cafés alone remain open, in one of which lately six blind musicians were in the habit of singing and playing. These men belonged to the orchestra of the Barcelona theatre, and all lost their sight by the

explosion of a bomb, thrown by an anarchist during a performance. In the other two cafés men and women from Andalusia dance and sing curious old melancholy airs handed down from Moorish times. In the Arab town all is silence and tranquillity, except on the occasion of some fête or marriage, when, in passing through some quiet narrow street, one may hear the sound of tambourines, flutes, and the Arab violin, accompanied by the shouts of the women; then suddenly a whole fusilade of shots from the inner court wakens the echoes of the neighbourhood. The marriage procession has already, earlier in the evening, paraded the streets, the bride in a closely-veiled palanquin on a mule's back, followed by a crowd of men and youths carrying on their heads huge candelabra with many candles, and escorted by a band of native musicians.

Curiously enough, the mosques are nearly all in the quarter now inhabited by Europeans, who do not look forward eagerly to the advent of Rhamadan, the Arab Lent, when, after fasting all day, the Faithful make the night hideous with their shouting and revelry. In some of the mosques, the dead are watched by a professional mourner, who, at two o'clock in the morning, begins to intone a kind of lugubrious *Dies Iræ*, which ceremony continues a full three-quarters of an hour. Just as one hopes to fall asleep again, a madman, who wanders about all the summer night, begins to shout and sing after his fashion. A window opens, there is a sound of falling water, a whole volley of blasphemies, and peace falls again on the troubled neighbourhood. But not for long! Dawn has scarcely shed its first light when the noises of the town begin again. Sounds of men and beasts going to market, cries of *Balak, Balak!* (out of the way!), the tinkling bells of the water-sellers announce that a new day has begun in all the various quarters of Tangiers.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

At a Meeting of Council held on December 20, the undermentioned ladies and gentlemen were elected Members of the Society:—

James Durham.
Chas. Francis Scott.
Judge Macpherson.
W. A. Cuthbertson.
Rev. David Paul, LL.D.
C. W. Cousland.
Miss Gibson.
Mrs. M. J. Johnston.
Geo. H. Middleton.
A. Francis Stewart.
A. K. Finlayson.
Robert M'Gowan.
George J. Lumsden.
William Jamieson.
Alfred S. Ritchie.
Hugh B. M'Gill.
Gilbert A. Syme.
David Tweedie.
Frank S. Goggs, A.I.A.
Miss C. M. Thomas.
Mrs. Thomson.
John Bathgate.
Mrs. Blues.
Mrs. Wodrow Thomson.
Miss Ethel Login.
Walter Cochrane.
Mrs. R. W. Black.
William Hamilton.
A. D. Watson.
James Anderson.
John Glover, jun., W.S.
Andrew G. Stenhouse.
Thomas Hume.
George Kerr Cockburn.
John Fraser, F.R.C.P.E.
A. D. Mutter Napier, W.S.
Edwin Robinson.
H. T. Methuen, C.A.
Charles W. A. Tait, M.A.
J. Kingsley Bell.
Miss Dundas.
Miss Mary E. Hamilton Hebden.
T. H. B. Black.
Jas. N. M'Dougall, M.D.
Miss J. Menzies.
Mrs. Andrew Usher.
Miss Cook.
R. Gibb, R.S.A.
Gilbert Goudie.
T. P. Manuel, W.S.
William Jamieson.
George Mill, S.S.C.
Robert Wilson.
John Elrick Fraser.
David Christison, M.D.
John Fraser.

Archd. W. Sturrock.
George E. Kidd.
John W. Bell.
John Nelson.
William Hood.
R. Bruce Lockhart.
Col. W. H. Fergusson.
Miss E. M. R. Reoch.
Robert Reid.
James Paul.
Joseph M'Gregor.
David Campbell.
Joseph Paton Maclay.
William R. Grieve.
Alex. Stewart Whyte.
Capt. James Tait.
Miss Octavia Paterson.
David Anderson.
William R. Haigh.
Foster Erskine.
Miss Jessie Muir.
Edward W. P. Newman.
John Watt.
J. Hope Gordon.
Prof. D. J. Medley.
Miss Jane J. Simpson.
J. T. Bottomley, M.A., D.Sc., F.R.S.
Robert Thom.
J. M. Finlayson.
William G. Kirkhope.
James C. Christie.
John Baird.
William Law, M.A.
John A. Dickie.
John Knox.
Miss Margaret M. Brand.
Wm. H. Blyth Martin.
R. G. Kennedy.
John M'Nicoll.
Robt. R. Smith.
C. J. Bisset.
Wm. W. Halley.
Wm. D. Fisher.
John Gibson.
James Young.
Wm. Kennedy
Miss Emily C. Thomson, M.B., C.M., L.R.C.P. Edin.

Lectures.

On the 30th November, in the Synod Hall, in the absence of Mr. W. S. Bruce, on account of illness, Mr. R. N. Rudmose Brown, Botanist of the Scottish National Antarctic Expedition, delivered an Address entitled "The *Scotia* in Antarctic Seas." The President occupied the Chair.

Mr. R. N. Rudmose Brown repeated his Address on the 19th December before the Dundee Branch, Mr. I. Julius Weinberg occupying the Chair, and on the 20th December before the Aberdeen Branch, Sir Allan Mackenzie, Bart., being in the Chair.

Owing to illness, Mr. Arthur Hill was not able to deliver his Address on "Lake Titicaca" before the Edinburgh and Glasgow Centres on 12th and 13th December; in his place Captain Voss gave an Address on his "Voyage Round the World in a Dug-out." Sir Colin J. Macrae occupied the Chair in Edinburgh, and Mr. W. F. G. Anderson in Glasgow.

Christmas Lectures to Children.

On the 23rd December, in the Free Assembly Hall, Mr. D. Eagle Clarke, F.L.S., delivered a Lecture to children entitled "Birds as Travellers." Lieut.-Colonel R. G. Wardlaw Ramsay occupied the Chair.

Mr. Eagle Clarke repeated his Address before the Glasgow Centre on the 29th, Dundee Centre on the 28th, and before the Aberdeen Centre on the 27th.

On the 28th December, in the Free Assembly Hall, the Secretary gave an Address to young people entitled "Adventures near the South Pole."

GEOGRAPHICAL NOTES.

EUROPE.

The Ben Nevis Observatories.—We have received a Memorandum from the Directors of the Ben Nevis Observatories, dated November 1904, which details the circumstances under which the Observatories were closed on October 1st. In an Appendix to the Memorandum an account is given of the finding of the committee appointed in 1902 to consider the administration by the Meteorological

Council of the Parliamentary Grant, and of the correspondence which ensued between the Scottish Meteorological Society and the Treasury in regard to the report of that committee. The appendix contains further some account of the relations between the Directors of the Observatories and the Meteorological Council.

Exploration in the Mentone Caves.—The well-known caves in the Rochers Rouges, near Mentone (cf. this *Magazine*, xix. p. 281), which have proved so rich in organic remains, were the subject of a paper read by M. Marcellin Boule in the early part of this year before the Société Géologique de France, and published in the Society's *Bulletin* recently (No. 1). The special object of the author's researches was the determination of the chronology of the deposits, in regard to which considerable doubt exists. In the Grotte du Prince, which has been very carefully excavated, the deposits consist of a superficial layer of material of continental origin, lying upon marine beds. The former beds can be divided into a number of layers, but the important point is that the upper and middle beds contain remains of reindeer, ibex, marmot, and rhinoceros, that is of the fauna of the cold period of the Quaternary; while below lie beds containing such forms as Elephas antiquus, Rhinoceros mercki and hippopotamus, that is the members of the lower Quaternary fauna. The underlying marine beds lie upon an old raised beach, which is also discernible outside the cavern at a mean height of seven metres above present level. Almost all the fossils belong to the existing Mediterranean fauna; nevertheless the author has found specimens of Strombus mediterraneus, a form characteristic of Quaternary raised beaches in the Mediterranean region. In the Prince's Grotto at a height of twenty-eight metres there are also other traces of marine action in the form of a calcareous deposit on the side of the cavern, below which the wall shows perforations by boring molluscs. The sequence of events is thus explained by M. Boule as follows. The sea formerly stood at the 28-metre level, and after a time gradually retired until it stood at the 7-metre level, where it remained stationary long enough for the Strombus beds to be deposited. Subsequently a continuation of the retreat laid bare a stretch of ground below the present shore-line wide enough to become the home of the large mammals who have left their bones in the cave. As these mammals belong in part to the lower Quaternary, the 7-metre beach must be of relatively great age.

ASIA.

Lake Baikal.—In connection with the recent opening of the trans-Baikal section of the Siberian railway (cf. vol. xx. p. 658), it may be of interest to summarise an article in *La Géographie* No. 3, cf. also *Petermann's Mitteilungen*, vii. on this lake, based on recent Russian investigations. Lake Baikal is one of the largest lakes of the globe, and in its extreme elongation, and the mountainous character of its shores, is best compared to Lake Tanganyika. It reaches a length of 600 kilometres, while its extreme width does not exceed 80 kilometres. The area is 34,000 square kilometres. According to Tcherski the lake is situated 484 metres above sea-level, but Suess places the figure at 512 metres. The mountains which surround the lake rise to 1400 metres above its level, and are for the most part placed close to the shore, this being especially true in the north-east region, where also depths of 1000 to 1500 metres occur close to the shore. The eastern shore-line rises less abruptly, and the depth of water near the shore is less, while in the south-west the mountains retreat from the lake to a distance of twelve kilometres. These peculiarities have for long been interpreted as indicating that the lake lies in a depression of the earth's crust. Formerly it was believed that the

lake had at one time been directly connected with the Arctic Ocean, but Tcherski showed that this connection can only have been indirect through the intervention of lakes and rivers. In 1897-1901 a hydrograph survey of the lake was carried out by Drischenko, who took about 225,000 soundings, which have made it possible to construct a detailed hydrographic map, while in 1900, 1901, and 1902, Korotnev carried out a zoo-geographical survey. The first-named survey has shown that the greatest depth is 1610 metres, which was obtained between Listvenitchnoe and Myssova in the southern region. A study of the temperature of the water showed that it is only in sheltered bays that it rises in summer to 13° or 14°, or even to 19°. In all other parts it does not rise above 4° even in July, and remains practically constant at all depths. The study of the life of the lake has shown that in this great body of fresh water there are distinct indications of those modifications of form in the depths hitherto only known in the abyssal fauna of the sea. This is apparently due to the fact that in the depths of the lake the conditions as to pressure, absence of light, etc., recall the conditions in the abysses of the sea. As regards the fauna generally, Lake Baikal is remarkable for its relative poverty in zoological groups, and for the wealth of species in the groups represented. There are no less than 300 species of Gammarids, and it is among these that the acquisition of abyssal characters with increasing depth is most marked. Below 600 to 700 metres they tend to lose their eyes, the body becomes colourless and transparent, the antennae become elongated. The plankton is abundant, and it is to this fact that Baikal owes its wealth of valuable fish. With the exception of microscopic forms and of Chara the lake proper contains no plants; only in the sheltered bays and in some of the streams do water plants such as Potamogeton occur. The question as to the origin of the fauna is interesting. The presence of a seal of marine origin has of course long been known, and apart from it Korotnev's work has shown the existence of other marine forms, such as some sponges, some Polychaetes, a mollusc (genus *Aucilodoris*), probably certain of the planarians, while the number of brightly-coloured and spine-bearing species of Gammarus also suggests a former sea connection. On the other hand, the general character of the fauna suggests a fresh-water origin, many of the fresh-water types having an archaic appearance. The general conclusion to be drawn from the fauna would therefore appear to be that Lake Baikal is the remnant of a very large body of fresh water which occupied Mongolia and Kashgaria at the end of the Tertiary epoch, which has persisted when other parts dried up on account of its great depth. It has, therefore, not only preserved the original fauna of this lake, but also contains forms which have either migrated to it from the sea direct, or from bodies of water left by the sea (Relikten-Seen).

AFRICA.

The Uganda Protectorate.—The Foreign Office has issued, as a Parliamentary paper [Africa, No. 12, 1904], Commissioner Sadler's general report on the Uganda Protectorate for the year ending March 31 last, of which the following are the most important conclusions :—

The general results of the year may be summed up in increased efficiency of administration and the maintenance of undisturbed peace and order; in a satisfactory increase of revenue and decrease of expenditure; in a large expansion of trade, particularly in imports; and in a general advance in material and social well-being, despite the fact that progress was hampered by the continuance of the sleeping sickness epidemic. The figures of revenue and trade speak for themselves. Revenue increased from £40,935 in the previous year to £51,474, being

in excess of the estimate by £10,539. The expenditure decreased from £203,733 to £186,800, representing a saving on the estimate of £4679. The hut-tax has been easily collected and has given rise to no trouble whatever; rupees are only demanded from those who can afford to pay in cash, the introduction of the local produce scheme has been of considerable help to the people, and the number of those who have had to pay their taxes in labour has largely decreased: the returns of the hut-tax collections in cash are significant of the increased tax-paying capabilities of the people; these have risen from £16,080 in 1901-1902, and £19,029 in the following year, to £24,758 during the year under report, showing the satisfactory increase in two years of £8678, or over 51 per cent. The value of the total trade amounted to £176,047, of which imports contributed £123,199 and exports £52,848, as against the returns of the previous year, incomplete for the first portion of the year, showing a total trade £94,717, of which imports represented £62,538 and exports £32,179. In social condition the Baganda have continued to make rapid strides, as is evidenced by the building of brick and iron houses by the chiefs, the use of furniture, groceries, and articles in common use in England, and the adoption of European methods of living; and by the commoner people in the change from bark cloth to cotton apparel, the use of petroleum to light their huts, and the increased demand for enamelled ware, boots, and shoes, and cheap articles of European manufacture; conditions which are permeating the neighbouring provinces. The natives show every indication of being happy and well contented with our rule, and I do not consider that Uganda will ever be a white man's country in the sense that South Africa is, and parts of East Africa will prove to be. The climate is not conducive to European colonisation, nor to European manual labour in the open. The development of the Protectorate will be by native agency under European supervision, and with the help of European capital; and it is here that the opportunities for British enterprise come in. Money could be profitably invested in the cultivation of cotton, coffee, fibre, and other products, in the collection and preparation of rubber and Sanseveria fibre, and very probably in the cultivation of tree rubber; the work would be done by paid native labour under the superintendence of the settler and his assistants. Generally speaking, the Government owns the uncultivated lands and the larger forests; where grants of lands are given in which native cultivation is situated it is on the distinct understanding that native rights are not interfered with. In Busoga and Bukedi there is a large amount of land available, and I should look upon these districts as perhaps the most fertile part of a peculiarly fertile country. Cattle rearing could be profitably undertaken in Ankole and Bukedi; Ankole is somewhat remote, but from Bukedi, which lies on the border of the sister Protectorate, there is sure to be an increasing demand for cattle by settlers in East Africa.

Sleeping Sickness in the Congo.—The members of the expedition despatched by the Liverpool School of Tropical Medicine have sent to the committee a long report on their experiences on the Congo. Dated from Stanley Falls, September 20, the report says:—

The members of our expedition left Leopoldville on June 23 and reached Stanley Falls on September 15. One of the State's steamers, the *Roi des Belges*, was very kindly placed at our disposal by the Government, and we were thus enabled to make fairly complete observations on the spread and distribution of sleeping sickness along the Congo River from the "Pool" to the "Falls," a distance of nearly one thousand miles. It is no exaggeration to say that sleeping sickness is a terrible scourge among, especially, the riverine tribes—who, by the

way, are generally totally distinct from the tribes living frequently only ten to thirty minutes' walk from the river banks. From Leopoldville to Bumba cases of sleeping sickness were present in practically every town visited, and the percentage of trypanosome-infected individuals among the general population was high. After Basoko and up the Falls only imported cases (with two exceptions) of sleeping sickness were seen in a few of the towns, and no trypanosomes were found in the general population. The inland towns which were examined, at M'Swata, Tschumbiri, Lisala, and Bumba, showed a much smaller percentage of trypanosome infections than did the corresponding riverine towns, and it was exceedingly rare to see a case of sleeping sickness. From our observations and from information which we have collected it is very apparent that sleeping sickness has spread in the Congo in recent years along the lines of communication—*i.e.* along the rivers. The spread of the disease has been much assisted by the practice of taking large bodies of natives, soldiers, and labourers from one part of the Free State to another. The tsetse fly was incessantly present from Stanley Pool to Basoko. These flies were very numerous among the myriads of islands with which the middle Congo is strewn, and frequently came on board our steamer while we were in mid-stream and distant 300 or 500 yards from land. After Basoko was passed there were very few flies, and just after we left the mouth of the Lomami river the last one was seen on the steamer. Although the natives of the towns at which we stopped above Basoko recognised the fly, none were found in the neighbouring bush. There is certainly a marked reduction in the number of tsetse flies above Basoko, and it is possible that there may be stretches of river where none occur. It is an interesting coincidence that where there were many tsetses there was much sleeping sickness. Where these flies were scanty, cases were rarely seen. The common species of tsetse on the middle Congo is *Glossina palpalis*. At Mensembe and Nouvelle Anvers this fly frequented the houses of Europeans.

AMERICA.

"Rain-making" among the North American Indians.—In *Symons's Meteorological Magazine* for November there appears an interesting and amusing article by Dr. H. R. Mill, under the title of "The Vengeance of the Rain-gods." The article gives an account of an expedition to the Grand Canyon of Arizona made by a party of members of the Eighth International Geographic Congress in August last. The expedition was made at a time of great drought, and at a Pueblo village on the open plain between Lamy and Albuquerque, in the territory of New Mexico, the party were fortunate enough to witness part of a "rain-dance" by the Indians, in spite of the great reluctance of the latter, who were evidently fearful of the effect of the presence of strangers and heretics on the rain-gods. The ceremony is not described by Dr. Mill in any detail, and there is of course nothing remarkable in its occurrence, for such ceremonies seem almost universal among primitive peoples, and have even their analogues among those who arrogate to themselves the title of civilised. The point of special interest is that the ceremony was followed in the course of a few days by a perfect downpour of rain. Dr. Mill does not fail to improve the occasion by drawing several useful morals; but it is perhaps unjust to dismiss the case simply as one of pure coincidence, for it will be remembered (see this *Magazine*, vol. xix. p. 658), that so careful an observer as Mr. Walter Roth notes that in North Queensland rain usually follows the ceremony of "rain-making," which he explains as the result of the fact that the ceremony is only performed at a time when rain is likely to fall, and only by experienced individuals, who seem to have some practical acquaintance with meteorology.

POLAR.

The Mylius-Erichsen Expedition.—On November 6 Mr. Mylius-Erichsen's expedition returned to Copenhagen, after an absence of two years and a half in Greenland. The special object of the expedition was to study the Esquimaux of the west coast of Greenland, notably those of the settlement at Cape York, the most northerly settlement known. The second winter was spent by the expedition in the district round Cape York, on Smith Sound, where the members of the party lived in Esquimaux fashion, and made a detailed study of the manners, customs, and mode of life of the natives. In travelling northwards, the expedition drove round Melville Bay on sledges, a feat never previously accomplished. It is expected that in addition to providing material for an exhaustive account of the tribes inhabiting the west coast of Greenland, the records of the expedition will add considerably to our knowledge of the geography of the district traversed. The expedition consisted of Mr. Mylius-Erichsen, who returned to Europe at the end of May last; of Mr. Knud Rasmussen, who was born and educated in Greenland, and is acquainted with the Esquimaux language, and of Count Harald de Moltke, a well-known painter.

Flora and Fauna of the Falkland Islands.—As these islands have attracted considerable attention lately in connection with the various Antarctic expeditions, it may be of interest to notice a paper upon them contributed by Mr. Rupert Valentine to the *Memoirs* of the Manchester Literary and Philosophical Society (xlviii.). The author in the first place gives some account of the "stone-rivers" of the islands, which consist of slowly moving blocks of quartzite between banks of peat. He is of opinion that the stones had approximately attained their present position before the formation of the peat, and the "rivers" have been produced by the denudation of the peat. In every stone-river patches of vegetation remain near the margins, these being most luxuriant where the denudation has been recent. Where the denudation is long-standing the sole remnant of the covering of vegetation is the bog-balsam (*Bolax globaria*), which, on account of its long tap-root, can penetrate downwards and obtain food after the superficial soil which supported other plants has been washed away. As a whole the islands are less desolate than is generally believed, the vegetation being locally abundant. One of the shrubby Veronicas (*V. decurrata*), for example, which has a beautiful scented flower, is plentiful on the shores of estuaries and coves in parts of the West Falkland.

As regards the fauna, the author finds that the Falkland Island wolf (*Canis antarcticus*), an animal of considerable zoological importance, has now been completely exterminated. Birds are numerous in the islands, especially penguins and the mollymauk or lesser albatross. An interesting point as regards one of the penguins—the rockhopper (*Eudyptes chrysocome*)—is that the surfaces of the hard rock across which many generations of the birds have passed are smoothed and scratched by their passage. The scratching is produced by the claws, and the marking, in combination with the general smoothing of the surface, might apparently be readily mistaken for the effects of ice-action.

Antarctic Meteorology.—We have received from Mr. Henryk Arctowski, of the *Belgica* Expedition, an abstract of a paper read by him before the Eighth International Geographic Congress in New York last September. The paper points out that although the recent Antarctic expeditions have produced a large mass of meteorological data, yet all this work must be regarded as of a provisional nature, and much yet remains to be done. What is now necessary is to have a consider-

able number of stations in the Antarctic and sub-Antarctic regions, all working simultaneously, and with this end in view he puts forward an elaborate scheme of international co-operation. The scheme involves first two floating stations, one a ship wintering in the ice in the region of the drift of the *Belgica*, the other in the Weddell Sea, while a third ship should explore the edge of the pack and study the variations of the ice throughout the year, while also making oceanographic researches. Of these vessels, the first two should each set up a station on the Antarctic lands in the vicinity of their respective regions, while the third ship should similarly set up four stations, one in the Falkland Islands, and one each in South Georgia, the Sandwich, and the Shetland Islands. In the region of Cape Horn there is already a good station on the island Ano Nuevo, near Staten Island, another should be established on one of the islands of Diego Ramirez, another at the lighthouse of Los Evangelistas, and finally there should be a mountain station on the summit of the mountain called Bonnet de la Republic, near Llopotaia. Mr. Arctowski reckons that the total expenses of this very elaborate scheme would not exceed about £132,000, which would be divided out among the nations taking part, and the result would probably be the solving of the meteorological problems of the Antarctic, while a large amount of oceanographic and other results would likewise be obtained.

The Scottish National Antarctic Expedition.—We are informed by Mr. W. S. Bruce that the Argentine Relief ship *Uruguay* sailed from Buenos Ayres for the South Orkney Islands, to relieve the Meteorological party at the station there about the middle of December. We may therefore expect the arrival of Mr. R. C. Mossman about the end of February.

Mr. W. G. Davis, of the Argentine Meteorological Department, writing to Mr. Bruce, says :—" I was delighted to read of the warm reception accorded to yourself and party on your return. It must have been an immense satisfaction to all concerned in the expedition to have brought back such a rich harvest of material as a result of your two years in the Polar Regions, and I feel confident that once all the results of the Antarctic expeditions are published, those of the *Scotia* will take a foremost place, not only for the amount of work done, but also for its quality."

In connection with this we may state that progress is being made with the working out of the Collection by various specialists, amongst whom may be named—Professor J. Arthur Thomson, who is doing the Alcyonaria ; Professor Hepburn, the histology of the Weddell seal ; Dr. Waterston, penguin development ; Mr. W. Eagle Clarke, the birds ; Mr. R. M. Clark, the plankton ; Mr. T. V. Hodgson, Pycnogonids and Isopods ; Sir Charles Eliot, Nudibranchs.

The Argentine Government and Meteorology.—Mr. W. S. Bruce is informed that the Argentine Government have resolved to continue the station at Scotia Bay for a third year, and thus for the first time in the history of Antarctic Exploration there will be a record of observations for three successive years from the same place. The new party consists of five men, four of whom have been in the employ of the *Officina Meteorologica Argentina*. The *Uruguay*, the vessel which is taking down the relief party, is, it may be remembered, the same vessel that effected the relief of the wrecked Nordenskjöld party in 1903. It is intended that the *Uruguay* shall go by way of New Year's Island and Ushaia, where a final supply of coal and water will be taken on board. The *Uruguay* will reach Scotia Bay, South Orkneys, about the middle of January.

Material is being taken out for a new house, 7 feet by 16 feet, and 7 feet high,

for the magnetic variometers. One end of this house is to be used for the developing room, separated from the main part by a double partition. The walls are of tongued and grooved boards, with a six inch space to be filled with sawdust; there will be a lining of rubberoid on the outside of the inner wall. Under these conditions it is hoped that it will be possible to maintain a fairly constant temperature in the building. Copeland Observatory, built by the Scottish Expedition, will be furnished with instruments for absolute determinations. It is hoped that it will be possible to obtain simultaneous observations from the two magnetometers—the Scottish one at present in use and the new Argentine instrument—while the *Uruguay* is in Scotia Bay.

Additional lumber is being sent to add to the store accommodation on the south side of Omond House, and a full supply of provisions, tools, materials, etc., is being taken south.

Mr. William S. Bruce is further informed that "the Minister of Marine of the Argentine Republic has a magnificent set of both meteorological and magnetic instruments which are to be installed this summer (1904-1905) at the Penguin Islands." Thus the islands in the South Atlantic are to be well supplied with magnetic and meteorological observations, Scotia Bay, South Orkneys, Penguin Islands, New Year's Island being all equipped by the Argentine Republic. That country deserves the greatest credit for such splendid enterprise. Besides these, there is Cape Pembroke, Falkland Islands, recently equipped and inspected by Mr. W. S. Bruce in co-operation with the British Meteorological Office. Monsieur Charcot, of *Le Français*, is also carrying out at the present time observations on the west side of Graham Land. All these, in co-operation with the splendid meteorological system, at present under the control of Mr. Walter G. Davis of the "Officina Meteorologica Argentina," over the whole of the Argentine Republic, form a unique series of observations in the history of meteorological and magnetical science. It is interesting to note that the Scottish National Antarctic Expedition is so largely associated with this work.

Further, Captain Larsen, who was master of the *Antarctic*, the vessel of the Swedish Antarctic Expedition, left Buenos Ayres in November for South Georgia with his whaling steamer *Fortuna*. The company under which he sails intends to make South Georgia a permanent station for the boiling down of whale blubber. Mr. Walter G. Davis has taken advantage of this, and has supplied him with a complete set of meteorological instruments, both for self-registering and direct observations, to be set up at South Georgia, where it will now not be difficult to have them frequently inspected.

COMMERCIAL GEOGRAPHY.

Cape-to-Cairo Railway.—Reuter's Agency learns that a further extension of the Cape-to-Cairo Railway to a point 350 miles north of the Zambesi has been decided upon. Sir Charles Metcalfe, the consulting engineer of the railway, who is now superintending the work on the Zambesi, reports that rapid progress is being made with the line to the north of the Victoria Falls, and it is expected that the railhead will be at Kalomo, the administrative centre of North-west Rhodesia (Barotseland) early in the present year. From Kalomo, which is one hundred miles north of the Zambesi, in pursuance of the decision noted above, the work will be continued in a north-easterly direction to Broken Hill, a point 250 miles beyond Kalomo.

Cotton-growing in the Sudan.—The journal of the British Chamber of Commerce of Egypt for the month of October states that the Sudan Government has

issued a report on "Cotton-growing in the Sudan," containing much interesting information, the result of various experiments and investigations made during 1902-03 in the following places:—(1) Shendi; (2) The country between Gedaref and Gallabat on the Rahad; (3) the Blue Nile and Dinder Rivers; (4) Senaar; (5) Bahr-el-Ghazal; (6) Dongola; (7) Suakim. The report also includes a note of instruction by the Director of Agriculture on the best method of cotton-cultivation, which has been translated into Arabic, and is being circulated throughout the Sudan. With the exception of the Bahr-el-Ghazal province, cotton of various kinds and qualities has been grown in all the above-mentioned districts with varying success, and the Director of Agriculture reports that Dinka Land—the alluvial plain between the ironstone plateau and the sudd basin—comprises an area of about 14,000 square miles, "of which at least half is suitable for and available for cotton-growing," so that Bahr-el-Ghazal also may yield good returns, provided the serious difficulties connected with labour and transport can be overcome. The heavy cost of transport and the want of population still constitute the main drawbacks to the development of the cotton-trade in the Sudan, and though a very low charge is made for the railway transport to Wadi Halfa, this is said to be at a loss to the administration, and could not be relied upon in dealing with large quantities.

Mineral Survey of Nigeria.—A note in *Commercial Intelligence*, which has just been added to our list of exchanges, reports that the Government has ordered a mineral survey of Northern Nigeria. Last year a survey of Southern Nigeria was begun, under the supervision of Professor Wyndham Dunstan. Hitherto the most interesting result has been the discovery of "monazite sands," resembling those found in Brazil, which are used commercially in the manufacture of incandescent gas mantles. If further exploration should prove the existence of these sands in considerable quantities, they may form an export of some value.

NEW BOOKS.

EUROPE.

Europe and the Far East. By R. K. Douglas. (Cambridge Historical Series. With five Maps. Appendix and Bibliography. Pp. 480. Cambridge University Press, 1904. *Price* 2*s.* 6*d.*

This volume comes with peculiar appropriateness just now when all eyes are turned to the Far East, and it ought to have a wide circulation. Sir Robert Douglas gives us a very clear, concise review of the relations between East and West. Beginning with a brief notice of the early commerce among the inhabitants of what is now Central China and the surrounding countries, some sixteen centuries before Christ, he passes on to the travels of Marco Polo and the earliest efforts of the missionaries. China may at least claim the merit of consistency; even in those early times she maintained her self-sufficing attitude. She did not want intercourse with the outside world, and she steadily built up all possible barriers to keep out the "Foreign Devils." Here and there in her history we find an Emperor more broad-minded than the majority, who would admit or even encourage trade and learning; such, for instance, was the Emperor Wan-leih who befriended Matteo Ricci, Superior-General of the Jesuits in China for many

years, and later the Emperor Kanghsi, who appears to have been a particularly enlightened ruler.

To pass on however to modern times, we come to the more direct and exclusive connection between Britain and the Celestial Empire. By the eighteenth century we find British trade predominating over that of other nations, a state of things which caused much heartburning and various collisions with the other powers, more especially France and Russia. Of all this we get a rapid yet accurate survey, showing how we gradually gained our point, opening out the country, not only to ourselves, but also to our rivals. Finally, Sir Robert Douglas gives a succinct account of the various disturbances of recent years, the Boxer Rising, Chino-Japanese War, and finally the beginning of the Russo-Japanese War, of which a remarkably clear outline is given.

The fault must be with the reader if he does not lay down this interesting volume with a very much clearer idea of the great Eastern empires than he has hitherto possessed. We speak, of course, of the general reader whose ideas are mostly gained from the newspaper, and to whom the names of men and places are familiar from current events connected with them rather than from any accurate study he may have bestowed upon them. All such—and we frankly acknowledge ourselves to be among the number—owe Sir Robert Douglas a very considerable debt of gratitude for enlightening them.

The appendix and bibliography are useful; the maps, perhaps, not quite up to the standard of excellence attained by the letterpress. The difficulty of presenting Chinese names in Roman lettering has been very satisfactorily surmounted.

ASIA.

Queer Things About Japan. By Douglas Sladen. Third Edition. London: Anthony Treherne and Co., Limited, 1904. *Price 7s. 6d.*

The fact that within a year it has been found necessary to issue three editions of Mr. Douglas Sladen's *Queer Things About Japan* is a sufficient proof, that amid the present spate of literature about Japan and things Japanese, his work is still very popular. The explanation is easily to be found in his crisp incisive style, his acute powers of observation, his generous enthusiasm for the gallant little Japs, his thorough knowledge of his subject, and the pleasant and masterly way in which he places his "Queer Things" before the reader.

En Corée. By Émile Bourdaret. Paris: Librairie Plon, Plon-Nourrit et Cie., Imprimeurs-Editeurs, 1904. *Prix, 4 francs.*

We gather from the first chapter of this work that M. Bourdaret has spent four years in Korea, and has thus been able to make what he thinks is a profound study of men and things there. It may be so, but he has been unable to do more for his readers than give them a very superficial account of Seoul the capital of Korea and its environs, and also some sketchy descriptions of one or two unimportant expeditions into the interior. He has added nothing to the general knowledge of Korea and its inhabitants. On the other hand we gather from various hints that France has hitherto taken very little interest in Korea, and it is quite possible that this work, although not of much use in England, may do good service in France by arousing interest in Korea, and by diffusing an elementary knowledge of some of its conditions. The impression it will give

to a Frenchman will probably be something like this : "Korea is a most miserable country except for its rice ; less civilised even than Annam ; much more dirty and sordid ; the inhabitants much less manly and enterprising ; the climate quite as deadly ; the prospects of commerce much less promising ; and the conditions of life generally less attractive, especially just now when Korea is the object of such demonstrative attentions from Russia on the one hand and from Japan on the other." Whether the author meant to convey that impression is quite another thing.

AFRICA.

The White Man in Nigeria. By G. D. Hazledine. With Illustrations and Map. London : Edward Arnold, 1904. Pp. 228. *Price* 10*s.* 6*d.*

Mr. Hazledine has given us an excellent account of Nigeria as he has seen it. While laying no claim to an exhaustive knowledge of the natives and their country, he yet leaves us with an impression that his portraits are probably more accurate than those of many who profess much more. He has hit upon a method of vivid characterisation too little used—*i.e.* he creates a typical man to stand for a tribe, and in a careful though rapid sketch of this conglomerate individual leaves us with a sharply defined picture not easily to be forgotten.

Mr. Hazledine points out that the white man's business, in this part of Africa at all events, is not so much to take possession as to teach the native how to possess wisely—a lesson he seems to think them fully capable of laying to heart. Perhaps he is a little inclined to over-rate the suitability of the country for cotton growing. It is true that the cotton grower has the advantage over his American rival in so far as there is no risk of frost injuring his crop ; but on the other hand he must be prepared for the not less deadly tornado. Probably the Egyptian Sudan will prove a better field for this branch of agriculture than Nigeria.

We quite approve of the author's deprecating a "British Cotton Trust" or large plantations on the American lines. As he says it will be much better "to leave the natives to cultivate such patches and districts as they think fit in their own way, and to continue the system of stationing experts in residence in some places, keeping them continually travelling about in others ; to organise transports and storage ; and to arrange for the ginning and packing, etc."

With the advent and extension of facilities for transport and the increased use of machinery, for which the natives seem to have a natural aptitude, though at present they require white overseers, the naturally large possibilities of the country will rapidly increase. In another generation we may find white settlements in the healthier districts only, whence the native labour can readily be supervised.

Before that day, however, the European had better acquire that insight and sympathy of which Mr. Hazledine appears to have so large a share, and by means of which he shows us that we may gain the confidence without losing the respect of the black man. At present it too often happens that "he forgets all about the dangers of interference with customs and habits he does not indulge in himself," though one would suppose that we had received lessons enough on this head to leave some impression. "At present the white men fail just as much to perceive his (the black's) good points as he fails to see theirs. The white men are about as blind as he is." Surely it is time for this state of things to come to an end.

GENERAL.

Das Erdsphäroid und seine Abbildung. By Dr. Emil Haentzschel. Leipzig: B. G. Teubner, 1903. Pp. vi – 140.

This small treatise is intended primarily for the student of cartography. The first part discusses the earth-spheroid, entering with sufficient fullness into the mathematics of the figure and the measurements of the various constants. In the second part the conform representation of the spheroidal surface elements on a spherical sphere is worked out in detail, and the transition made to the familiar Mercator's projection—the "conform double projection." The mathematical demonstrations and arithmetical calculations are given in full, Bessel's constants for the earth being used throughout.

Students' Laboratory Manual of Physical Geography. By A. P. Brigham, Professor of Geology in Colgate University. (Twentieth Century Text-Books.) New York. D. Appleton and Co. 1905. Pp. 153.

The United States have produced a type of mind which is distinguished by its ingenuity and originality. Whether this type applies itself to Geography, Chess, or Golf, it originates new effects and introduces novel and successful methods. The volume before us is an example, for its author, instead of simply stating, as has so frequently been done, the principles of physical geography, endeavours by means of a series of searching questions, which the student has to put to himself, to probe to its depth his knowledge, or ignorance, of the various problems of physical geography. Every question is so practical, and relates to phenomena which are sometimes beautifully illustrated in the volume, that the earnest student will not only find the book of great interest, but also, if he is preparing for examinations, of incalculable value. As a specimen of Professor Brigham's method of examination, take the following: *Field Study of Flood-plains and Meanders.* "How wide is the flood-plain? Is the stream midway or nearer one side? Is the plain smooth, or interrupted by old channels? Are any parts of it higher than others? If higher along the stream, why? See Text-Book, page 47. How much water in the stream—that is, is it an average height, or low, or high? If you have seen it washing over the flood-plains, describe. Why would earth and coarser waste be left on the fields at such a time? How has the plain been built up? How much does the stream vary from a direct course through its flood-plain? Make a plan or map of its curves, showing it in either direction as far as you can see distinctly. Sketch in also the outer borders of the flood-plain at the base of the valley sides. Make a cross profile of valley, including stream, plain and slopes. Select a curve for study. How great is the sidewise swing which it makes? Does it curve so strongly as to make an ox-bow? What is the form of the bank on the outside of the bend? On the inside? Why? How deep is the water on two sides of the stream? Will the spur within the bend grow longer? What will happen to the bluff on the other side? How will these changes affect the form or size of the meander? Can you find a place where a "cut-off" has taken place, or may soon take place? Can you find abandoned meander courses on the flood-plain? Do they show meadow, marsh, or lagoon? If you have seen a meandering stream much larger or smaller than this, how wide was the swing of its meanders, as compared with those seen here?

"How do the fields on the flood-plains compare with the hillsides, as respects homes and crops? Where are most of the pastures and forests? Why? Compare the soils with those of the uplands. If the valley is spacious, where are the railway and chief highways?"

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

India. By Colonel Sir Thomas Holdich, K.C.M.G. (Regions of the World Series.) Large 8vo. With Maps and Diagrams. Pp. xii + 375. *Price* 7*s.* 6*d. net.* Oxford University Press, 1904.

Among the Burmans: Record of Fifteen Years of Work and its Fruitage. Illustrated. 8vo. Pp. 282. *Price* 4*s. net.*

The Native Tribes of South-East Australia. By A. W. Howitt, D.Sc. Large 8vo. Pp. xix + 819. *Price* 21*s. net.* London : Macmillan and Co., 1904.

The Face of the Earth (Das Antlitz der Erde). By Eduard Suess, Professor of Geology in the University of Vienna. Translated by Hertha B. C. Sollas, Ph.D., under the direction of W. J. Sollas, Sc.D., LL.D., M.A., with a Preface written specially for the English translation by Professor Suess. Volume I. Royal 8vo. Cloth. 4 Maps and 50 Illustrations. Pp. xii + 604. *Price* 25*s. net.* Oxford University Press, 1904.

Adventures in Tibet. By Sven Hedin. Illustrated. In one volume. Demy 8vo. *Price* 10*s.* 6*d. net.* London : Hurst and Blackett, 1904.

Agricultural and Pastoral Prospects in South Africa. By Colonel Owen Thomas. Demy 8vo. *Price* 6*s.* London : Archibald Constable and Co., 1904.

Wanderings in the Great Forests of Borneo : Travels and Researches of a Naturalist in Sarawak. By Dr. Odoardo Beccari. Revised and Edited by F. H. H. Guillemard, M.A. Demy 8vo. Pp. 468. *Price* 16*s. net.* London : Archibald Constable and Co., 1904.

The Campaign with Kuropatkin. By Douglas Story. Illustrated. Demy 8vo. Pp. xii + 301. *Price* 10*s.* 6*d. net.* London : Werner Laurie, 1904.

The Story of My Struggles: The Memoirs of Arminius Vambery, C.V.O., Professor of Oriental Languages in the University of Budapest. Photogravure and other Illustrations. 2 vols. Vol. I. pp. xii + 236, vol. II. pp. x + 492. *Price* 21*s. net.* London : T. Fisher Unwin, 1904.

Marco Polo's Travels. (Newnes' Thin Paper Classics.) Crown 8vo. Cloth, 3*s. net* ; Limp lambskin, 3*s.* 6*d. net.* Pp. xxxix + 461. London : George Newnes, 1904.

Tales of Travel : Land and Water : Our English Homes : Europe. 4 vols. (Round the World Geographical Readers.) *Prices* 10*d.*, 1*s.*, 1*s.* 3*d.*, and 1*s.* 4*d.* London : T. C. and E. C. Jack, 1904.

England and the English. By Dr. Carl Peters. 8vo. Pp. viii + 400. *Price* 6*s. net.* London : Hurst and Blackett, 1904.

Dans les Rapides du Fleuve Bleu, Voyage de la Première Canonnière Française, Sur le haut Yang-tse-Kiang. Par le Lt. de Vaisseau Hourst. Préface de M. Jules Lemaître. Illustrated. 8vo. Pp. iv + 370. Paris : Librairie Plon, 1904.

Erythräa und der Ægyptische Sudân : Auf Grund eigener Forschung an Ort und Stelle. Dargestellt von Professor Dr. E. Dagobert Schoenfeld. Mit 15 Tafeln, enthaltend 20 Lichtdrucke. *Preis* 8 *mark.* Berlin : Dietrich Reimer (Ernest Vohsen), 1904.

The Survey Gazetteer of the British Isles : Topographical, Statistical, and Commercial, compiled from the 1901 *Census and the latest Official Returns.* Edited by J. G. Bartholomew, F.R.S.E., F.R.G.S. With Appendices and Special Maps. Pp. viii + 928. *Price* 17*s.* 6*d. net.* London : George Newnes, Ltd., 1904.

Through Town and Jungle: Fourteen Thousand Miles Awheel among the Temples and People of the Indian Plain. By WILLIAM HUNTER and FANNY BULLOCK WORKMAN. With Map and 202 Illustrations. Medium 8vo. Pp. xxiv + 380. *Price* 21*s. net.* London: T. Fisher Unwin.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreirn books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st October 1904:—One-inch Map, Third Edition, engraved, in outline. Sheets 6, 32 (Price 1s. 9d. each). With hills, printed in colour. Eyemouth, Sheet 34 (Price 1s. 6d.).

Six-inch and Larger Scale Maps.—Six-inch Maps (Revised, full sheets, engraved, without contours). *Ross-shire and Cromartyshire.*—Sheets 106, 125 (Price 2s. 6d. each); Sheet 126 (Price 2s.).

Parish Maps (1:2500 Scale, Revised, with Houses ruled, and with areas. Price 3s. each). *Banffshire.*—Sheets II. 2, 3, 5, 6, 7, 10, 11, 14, 15, 16; III. 13; VIII. 2, 3, 4, 6, 7, 8, 10, 11, 12, 15, 16; IX. 1, 5, 13; XIV. 4, 8, 12; XV. 9; XXIX. (7 and 6), 8, 11, 15, 16; XXX. 7, 8, 10, 13, 14. *Inverness-shire.*—Sheets III. 16; IV. 7, 11, 13, 14, 15; X. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XI. 3, 5, 9, 12, 13, 16; XII. 3, 9, 10, 11, 12, 13, 14, 15, 16; XVIII. 1, 2, 3, 4; XIX. 4, 11, 13; XX. 1, 2, 3, 4, 6, 7, 10, 11, 14; XXXI. 13.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

General Memoirs.—Summary of Progress of the Geological Survey of the United Kingdom for 1903 (Price 1s.).

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th November 1904:—One-inch Map (Third Edition), engraved, in outline. Sheets 10, 11, 16, 25 (Price 1s. 9d. each).

Six-inch Maps (Revised), Quarter Sheets, Heliozincographed, with Contours (Price 1s. each). *Aberdeenshire.*—4 SE.; 5 NW., 5 NE.; 17 NE. *Banffshire.*—10 SE.; 11 NW., 11 NE.; 21 NE.

Parish Maps (1:2500 Scale, Revised, with Houses ruled, and with areas. Price 3s. each). *Banffshire.*—Sheets IX. 9; XIV. 2; XV. 1, 5, 14; XX. 4, 7, 11; XXIV. 13; XXIX. 2, 4, 12; XXX. 9; XXXV. 4; XXXVI. 1, 2. *Inverness-shire*—Sheet XII. 7.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

ADMIRALTY CHART. Southern Part of Sound of Raasay and Inner Sound, No. 2498 (160). Scale 1:26,750. November 1904. *Price* 2*s.* 6*d.*

TIDAL STREAMS OF BRITISH ISLES. A series of twelve maps showing the direction of the current at each hour of the tide. No. 2287 (3552). Published under the superintendence of Captain A. Mostyn Field, R.N., Hydrographer. November 1904. *Price* 2*s.* *Admiralty Office, London.*

IRELAND. Bartholomew's "Quarter-inch to Mile Map." Sheet 1, Donegal and Enniskillen; Sheet 3, Connemara and Sligo. Reduced by permission from the

Ordnance Survey, and coloured in contours to show height of land. Roads specially revised by the Cyclists' Touring Club. *Price per sheet*, 1*s. paper; mounted on cloth*, 2*s.* *John Bartholomew and Co., Edinburgh.*

These sheets complete the publication of this new map of Ireland in sheets. It represents a reduction of the Ordnance Survey with the addition of contours of elevation and a graded colouring of roads according to quality of surface.

AFRICA.

AFRICA.—War Office Map on scale of 1 : 1,000,000 or about 16 miles to an inch. District sheet 82, Fernando Po. 1904. *Price* 2*s.*
Intelligence Division, War Office, London.

ANGLO-EGYPTIAN SUDAN.—War Office Map on scale of 1 : 250,000 or about 4 miles to an inch. 1904. District Sheets—46-J, Kavora; 55-C, Geili; 55-D, Rera; 55-E, Kagmar; 55-G, Wad Medani; 55-H, Gedaref; 55-I, El Obeid; 55-K, Sennar; 55-L, Doka; 55-O, Karkoj; 55-P, Middle Dinder; 56-A, Kassala; 56-I, Nogaro; 66-C, Roseires. *Price* 1*s.* 6*d. each sheet.*

ANGLO-EGYPTIAN SUDAN INDEX MAP.—On scale of 1 : 4,000,000. 1904.
Intelligence Division, War Office, London.

As the above-mentioned Index-Map shows, the complete map of the Anglo-Egyptian Sudan consists of 206 sheets, of which 56 are already published.

CONGO FREE STATE.—General Map on scale of 1 : 4,000,000 or about 64 miles to an inch. October 1904. *Price* 6*s.*
Intelligence Division, War Office, London.

AMERICA.

UNITED STATES.—Geologic Atlas, Folios for the following districts:—Hartville, Wyoming; Gaines, Pennsylvania; Brownsville-Connellsville, Pennsylvania; Columbia, Tennessee; Olivet, S. Dakota; Parker, S. Dakota; Tishomingo, Indian Territory; Mitchell, S. Dakota; Alexandria, S. Dakota; Indiana, Pennsylvania; San Luis, California; Nampa, Idaho-Oregon; Pakota, Indiana; Mount Stuart, Washington; Silver City, Idaho. Mapped on varying scales of 1 mile to an inch, 2 miles to an inch, and 4 miles to an inch.
United States Geological Survey, Washington, D.C.

These district folios comprise a complete survey of all the geographical aspects of each district. The treatment is most complete and elaborate, commencing with general topography and geology, economic geology, with sections, and faunal chart, each section accompanied by descriptive text and illustrations.

GENERAL.

WIND CHARTS FOR SOUTH ATLANTIC OCEAN.—A series of twelve monthly charts prepared in the Meteorological Office. *Price* 7*s.*
Admiralty Office, London.

L'ANNEE CARTOGRAPHIQUE.—Quatorzième Année. Dressé et rédigé sous la direction de F. Schrader. Novembre 1904. *Price* 3 *fr.*
Librairie Hachette et Cie., Paris.

This useful annual gives a cartographic and descriptive summary of geographical exploration and political frontier changes throughout the world for the year 1903.

HANDY ATLAS OF THE BRITISH EMPIRE.—A series of 120 maps and plans with Statistical Tables and a Gazetteer of British Possessions, by J. G. Bartholomew, F.R.G.S. *Small 8vo. Price* 1*s. cloth*, 2*s. leather.*
George Newnes, Limited, London.

THE SCOTTISH
GEOGRAPHICAL
MAGAZINE.

BOTANICAL SURVEY OF SCOTLAND.

(*With Map and Illustrations.*)

III. and IV.—Forfar and Fife.

By William G. Smith, B.Sc., Ph.D., University of Leeds.

(*Continued from page* 23.)

The Grampian Area.

This area includes that part of Forfarshire north of Strathmore, and situated on the southern slopes of the great highland plateau of the Eastern Grampians. The plateau lies at an altitude of over 3000 feet between Strathmore and the valley of the Dee, and includes the summits of Driesh, Mayar, Tolmont, and Cairn-na-Glasha (3484 feet). Sir Archibald Geikie (1901) referring to this plateau says: "It would hardly be exaggeration to say that there is more level ground on the tops of these mountains than in the valleys below." A plateau of this size and at this elevation must have a considerable influence on the topography and vegetation in its neighbourhood, and it is only by appreciating its existence that the moorlands of this part can be understood. The plateau itself could not be included in the present map, but the vegetation has been recorded on my brother's field-maps, and an account of his survey of the vegetation of Forfarshire would be incomplete if his notes were not incorporated here. A full consideration of the Eastern Grampians cannot be attempted until the whole area, including the basin of the Dee, has been worked over.

The moorland of the Grampians includes both sub-arctic (*sub-alpine*)

and arctic (*alpine*) forms of vegetation. If the tree limit be taken as the upper boundary of the sub-arctic region, then it is about 2000 feet, the altitude attained by the Caenlochan larch forest. This altitude was adopted in Northern Perthshire on other grounds than the tree limit. The chief of these is that about 2000 feet a number of the heather associates become scarce or cease, while blaeberry and other species increase in a marked degree. In Forfar, as in Northern Perthshire, the line of 2000 feet on the Ordnance Survey maps has been adopted as the limit between the sub-arctic and arctic regions. Some elasticity should, however, be allowed, because local conditions may alter the limits, and the conditions of survey are unfavourable to precise definition.

The heather moor and the grassy hill pasture—the dark moors and the green—are the extreme types of the moorland, and in the present map there are well-defined areas of these, bearing a close relationship to geological features of the district. The vegetation as one passes northwards and upwards from Strathmore falls into a series of zones. These will be considered in the order of their increasing altitude :—

(1) A narrow zone of grassy foot-hills along the northern side of Strathmore.

(2) A zone of heather vegetation.

(3) A zone of hill pasture.

(4) The arctic or alpine region.

The Foot-hills are clearly recognisable in the range between Menmuir and Fearn, which includes Mansworn (1009 feet), Tollo Hill, and Deuchar Hill (970 feet). West of this the range is broken in the basin of the South Esk, but may again be recognised in Strone Hill (1074 feet) and other hills round Lintrathen and Alyth. The moorland is grass heath of the Sidlaw and Ochil type, occasionally with admixture of heather, and the grassy hills stand out sharply against the dark heather moors beyond. The geology is also similar to the andesitic hills of the Sidlaws, and is distinct from that of the heather moors. The foot-hills are essentially of the same type as the Sidlaws and Ochils.

Heather Moor.—Reference to the map will show that the heather moorland covers an extensive area, and extends northwards till it is replaced by a higher zone of hill pasture. Tracing the heather moor from east to west, it gradually increases and attains a maximum area in the botanical map of Northern Perthshire (1900 B). In the western part of that map it is replaced by the grassy vegetation of Ben Lawers and the Breadalbane Mountains, and by the peat bogs which begin on Rannoch Moor. The distribution of heather moor in Perthshire and Forfar is closely co-extensive with the occurrence of two formations, indicated in the Geological Survey one-inch maps as mica schist and quartzite with quartzite schist. The heather vegetation over this area is chiefly that distinguished in these papers as heather moor. Lists of species from all parts show a preponderance of *Calluna* with associates which indicate good drainage and a moderate depth of peat. The following were found on Cairn o' Barns from 1000 to 1250 feet, and on the eastern side of Glen Clova at Rough Craig (1400 feet).

Dominant Social.	Other Associates.
Calluna Erica, D.C.	*Anemone nemorosa*, L.
	Ranunculus acris, L.
Sub-Dominant Social.	*Helianthemum Chamæcistus*, Mill.
	Viola Riviniana, Reich.
Vaccinium Myrtillus, L.	*Polygala vulgaris*, L.
V. Vitis-Idæa, L.	*Linum catharticum*, L.
Erica cinerea, L.	*Trifolium repens*, L.
Empetrum nigrum, L.	*Lotus corniculatus*, L.
Nardus stricta, L.	*Alchemilla alpina*, L.
Anthoxanthum odoratum, L.	*Saxifraga aizoides*, L.
Pteris aquilina, L.	*Drosera rotundifolia*, L.
Potentilla silvestris, Neck.	*Campanula rotundifolia*, L.
Galium saxatile, L.	*Arctostaphylos Uva-ursi*, Spreng.
Antennaria dioica, R. Br.	*Pyrola minor*, L.
Scirpus cæspitosus, L.	*Trientalis europæa*, L.
	Pedicularis sylvatica, L.
	Pinguicula vulgaris, L.
	Thymus Serpyllum, Fr.
	Rumex Acetosa, L.
	Salix aurita, L.
	S. repens, L.
	Listera cordata, R. Br.
	Orchis maculata, L.
	Carex binervis, Sm.
	Lastræa Oreopteris, Presl.
	L. dilatata, Presl.
	Polypodium vulgare, L.
	Lomaria Spicant, Desv.
	Juniperus communis, L.

Some of the badly drained troughs are occupied by plants of the moss moor on deep peat; the larger of these are indicated on the map.

The transition from heather along the northern limit of the zone coincides with changes in the geology rather than with any distinct change in altitude or climate. A good example of this occurs between Kirkmichael and Blackclunas in Glenshee. Here a tract, which as regards altitude and climate is within the heather zone, shows a vegetation of grassy pasture and farmland. The change is coincident with the appearance of limestones amongst the surface rocks, and these in providing a richer soil have favoured a grassy vegetation, while topographical changes resulting from erosion of the limestones have provided sheltered conditions favourable to cultivation. While it is not possible as yet to trace in this way every change from heather to hill pasture, the transition may be regarded as more or less coincident with the beginning of the geological structure typical of the high plateau and its margins. This is described by Sir Archibald Geikie as "the upturned edges of vertical and contorted schists shorn off by planes of erosion." Over the more continuous schist formations, the country is made up of comparatively gentle slopes, which, along with frequent glacial deposits,

provide conditions favourable to peat formation. From what is known of the soil-requirements of the heather vegetation, it may be concluded that the soil is poor, and this is borne out by the limited extent and the scanty produce of the farmland within the heather region. The grass vegetation of the hill pasture, on the other hand, is favoured by the frequent outcrops of steeply tilted strata. The soil will thus be derived from rocks both rich and poor in food-material, while underground drainage will be facilitated. The contours of the hill-pasture area are also steeper, so that surface drainage into the numerous valleys is easy.

Upper Hill Pasture.—This is shown on the present map only in the north-west corner, but its presence has been traced in each of the great valleys eastwards to the North Esk. It thus forms a zone above the heather and below the vegetation of the main plateau. Within this zone one must also include the summits of several hills in the heather area (*e.g.* Catlaw, 2196 feet; and Corwharn, 1998 feet), where the summit vegetation is one in which *Nardus stricta* and *Juncus squarrosus* are dominant plants. The erosion of these summits has prevented the formation of peat, and has brought the rocks nearer to the surface, with the result that peat plants have not obtained a hold. A similar grassy summit vegetation has also been found in Yorkshire (Smith and Rankin, 1903) and in Westmorland (Lewis, 1904) as a feature of summits standing above surrounding peat areas. The range of grassy hills in the north of Forfar shows this form of hill pasture not as a summit cap, but as a zone above the heather. The lower slopes (1500-2500 feet) are covered with a close grassy vegetation in which the heather plants are quite subordinate. At intervals crags and scars occur which shelter a flora somewhat different from the grassy slopes. The summits are alpine or arctic in character, and the transition from the vegetation of the slopes is gradual and imperceptible. The following lists are typical of the grassy hills of the Clova district, Glen Isla, and the range between Glenshee and Glen Fernach.

Hill Pasture from 1500 to 2500 Feet.

Dominant and Social.	Scattered.
Nardus stricta, L.	*Viola Riviniana*, Reich.
Vaccinium Myrtillus, L.	*V. lutea*, Huds.
Juncus squarrosus, L.	*Polygala vulgaris*, L.
Deschampsia flexuosa, Trin.	*Antennaria dioica*, R. Br.
Agrostis vulgaris, With.	*Gnaphalium sylvaticum*, L.
Festuca ovina, L.	*Vaccinium uliginosum*, L.
	Calluna Erica, D C.
Sub-Dominant.	*Erica cinerea*, L.
	Melampyrum pratense, L.
Potentilla silvestris, Neck.	*Trientalis europæa*, L.
Alchemilla alpina, L.	*Rumex Acetosa*, L.
Galium saxatile, L.	*Narthecium Ossifragum*, Huds.
Vaccinium Vitis-Idæa, L.	*Scirpus cæspitosus*, L.
Scabiosa Succisa, L.	*Carex pilulifera*, L. Dry places.
Euphrasia officinalis, L.	*C. binervis*, Sm. „

Luzula campestris, D.C.
Eriophorum vaginatum, L. (On peat).
Rubus Chamæmorus, L. „
Empetrum nigrum, L. „
C. flacca, Schreb. Wet and dry places.
C. echinata, Murr. Wet places.
C. flava, L. Wet Places.
C. panicea, L. „
C. fulva, Good.
Molinia varia, Schrank.
Lomaria Spicant, Desv.
Lycopodium clavatum, L.

Crags or Hill Cliffs, 1250 to 2000 Feet. (Species Scattered.)

Helianthemum Chamæcistus, Mill.
Viola Riviniana, Reich.
Polygala vulgaris, L.
Hypericum pulchrum, L.
Geranium Robertianum, L.
Oxalis Acetosella, L.
Cytisus scoparius, Link.
Trifolium repens, L.
Lotus corniculatus, L.
Rubus Idæus, L.
R. saxatilis, L.
Alchemilla alpina, L.
Rosa, spp.
Epilobium angustifolium, L.
E. montanum, L.
Galium verum, L.
G. saxatile, L.
Scabiosa Succisa, L.
Senecio Jacobæa, L.
Cnicus lanceolatus, Willd.
C. palustris, Willd.
Campanula rotundifolia, L.
Vaccinium Myrtillus, L.
Calluna Erica, D.C.
Erica cinerea, L.
Scrophularia nodosa, L.
Digitalis purpurea, L.
Veronica officinalis, L.
Thymus Serpyllum, Fr.
Plantago lanceolata, L.
Ulmus montana, Stokes.
Betula pubescens, Ehrh.
Corylus Avellana, L.
Luzula maxima, D.C.
Anthoxanthum odoratum, L.
Deschampsia flexuosa, Trin.
Festuca ovina, L.
Asplenium Trichomanes, L.
Cystopteris fragilis, Bernh.
Lastrea Oreopteris, Presl.
Cryptogramme crispa, R. Br.
Polystichum Lonchitis, Roth.

The two lists given above show that the vegetation is essentially the same as the grass heath of the Sidlaws and Ochils, and the basaltic crags of these ranges respectively. The chief difference is that the higher zone of hill pasture shows a greater development of blaeberry and plants characteristic of mountains, *e.g. Alchemilla alpina*, *Rubus Chamæmorus*, and species of *Lycopodium*. The zone is thus intermediate between the sub-alpine grass heath and the alpine Vaccinium zone. It may be regarded as either grass heath with admixture of mountain species, or Vaccinium vegetation with a preponderance of plants characteristic of the lower ranges of hills.

The Arctic or Alpine Region.

This lies entirely on the Forfar-Aberdeenshire plateau from about 2000 feet upwards to the summits of the highest mountains, *e.g.* Glas Maol (3502 feet), Tolmont (3143 feet), Broad Cairn (3268 feet), Driesh (3105 feet), etc. Although the plateau scarcely comes within the limits of the present map, the greater part of it has been visited. The chief features of the Alpine region have already been dealt with in the paper

on Northern Perthshire (1900 B.). There the summits were divided into three groups:—

(*a*) The Breadalbane mountains, which are grassy with an association of plants hardly differing from the pasture of the sub-alpine region except in the abundance of its characteristic species (*Alchemilla alpina*, L.).

(*b*) The second type of mountain is also largely covered with grasses, but with the blaeberry (*Vaccinium Myrtillus*) very much mixed with them, and little heather.

(*c*) The third type is still poorer. Grasses are here relatively rare, and peat plants in contrast dominate. Heather, although abundant, is nowhere in very good condition, and is partly superseded as dominant species by *Vaccinium Myrtillus*. This mixture is indicated on the map by colouring this association the same as that of *Vaccinium*, and dotting the heather colour over it.

The alpine vegetation of the Forfarshire Grampians belongs to the latter two of the above groups, those in which *Vaccinium* is dominant either with or without *Calluna*. The extensive deposits of peat characteristic of the plateau greatly favour peat-plants. At the same time the geology of the plateau is favourable to the formation of numerous moist and sheltered crags where many plants of the Breadalbane type may be found.[1] Hence the mountains of Clova and Caenlochan, with those of Breadalbane, have become well known from their wealth of rare species. George Don (born 1764, died 1814) was amongst the first to reveal the botanical rarities of these mountains, and William Gardiner, in his *Flora of Forfarshire* (1848), gives many quaint and interesting notes on the vegetation. Since then many attempts have been made to describe the rugged grandeur and botanical wealth of this district.

The chief factors which determine the distribution of the vegetation are climate and conditions of drainage. The change from the sub-alpine to the alpine vegetation is mainly determined by climate. The sub-alpine plants extend upwards as far as they can, and their loss of position makes way for those species which are able to maintain themselves under more rigorous climatic conditions. The drainage depends on the nature and weathering of the rocks, since these determine to a great extent the undulating slopes, rocky crags, and other features of the topography. The occurrence of peat, partially or completely masking the relation between the vegetation and the underlying rocks, is in this area an important factor. The analysis of the vegetation can only be carried as far as our records extend, and, in this inaccessible region, is probably incomplete. The chief feature is the dominance of blaeberry (*Vaccinium Myrtillus*) and its associates. The ling or heather (*Calluna Erica*) loses its conspicuous dominance at about 2000 feet, although it may rise under suitable conditions to a higher altitude in association with the blaeberry. The adaptability of the blaeberry is well illustrated in this area. It occurs almost at sea level, and is present in the grass heath, dry heath,

[1] The similarity between the flora of the alpine crags of Caenlochan, Clova, and Breadalbane has been traced by Mr. Macnair (1898) to the occurrence in these areas of certain strata of sericite (chloritic) schist.

heather moor and peat bog on all the lower hills, but always as a sub-dominant species. Above 2000 feet it advances into dominance over its sub-alpine associates: this position it retains until near the exposed summits of the higher mountains, when it becomes dwarfed, and finally disappears. The blaeberry also shows its powers of adaptation by retaining the dominant place under variations of soil which have considerable influence on its associates of the alpine region. The most marked of the *Vaccinium* associations are:—

(*a*) *Vaccinium*-grass (V on map). This is best developed on the upper part of those hills which have a grassy vegetation on their lower slopes. The association occurs where the drainage is good, and where peat, if present, is shallow, and liable to become dry in times of drought.

(*b*) *Vaccinium* dominant along with *Calluna*. This corresponds to the third type of mountain vegetation in Northern Perthshire (V.H.). It is found on deep peat accumulated in moist conditions in the hollows and on slopes of the plateau between 2000 and 3000 feet.

Extensive areas of these two associations occur, but much of the area is intermediate in character, presenting the one and the other extreme within short distances according to the depth and moistness of the peat. *Vaccinium* (without *Calluna* as a co-dominant) may also occur on deep peat with cotton grass and other associates characteristic of this sub-stratum. The following plants occurring with *Vaccinium* above 2000 feet are arranged in two series; the one includes those observed in well-drained conditions with shallow peat, the other includes plants found on deep moist peat.

Vaccinium and Grass.	Vaccinium and Calluna.
Dominant or abundant sub-dominant.	
Vaccinium Myrtillus, L.	*Vaccinium Myrtillus*, L.
Festuca ovina, L.	*Calluna Erica*, D.C.
Agrostis vulgaris, With.	*Empetrum nigrum*, L.
Deschampsia flexuosa, Trin.	*Vaccinium Vitis-Idæa*, L.
Nardus stricta, L.	*V. uliginosum*, L.
Anthoxanthum odoratum, L.	*Erica Tetralix*, L.
Alchemilla alpina, L.	*Eriophorum vaginatum*, L.
Vaccinium Vitis-Idæa, L.	*E. angustifolium*, Roth.
Empetrum nigrum, L.	*Scirpus cæspitosus*, L.
Carex rigida, Good.	*Molinia varia*, Schrank.
Species scattered or only locally abundant.	
Viola Riviniana, Reich.	*Caltha palustris*, L.
Polygala vulgaris, L.	*Rubus Chamæmorus*, L.
Geranium sylvaticum, L.	*Saxifraga stellaris*, L.
Trifolium repens, L.	*Drosera rotundifolia*, L.
Vicia sepium, L.	*Cornus suecica*, L.
Lathyrus montanus, Bernh.	*Schollera Oxycoccus*, Roth.
Potentilla silvestris, Neck.	*Arctostaphylos Uva-ursi*, Spreng.
Saxifraga hypnoides, L.	*Trientalis europæa*, L.
Galium saxatile, L.	*Pinguicula vulgaris*, L.

Solidago Virgaurea, L.
Gnaphalium supinum, L.
Achillea Millefolium, L.
Crepis paludosa, Moench.
Campanula rotundifolia, L.
Calluna Erica, D.C.
Veronica officinalis, L.
Euphrasia officinalis, L.
Melampyrum pratense, L.
Polygonum viviparum, L.
Rumex Acetosa, L.
R. Acetosella, L.
Luzula campestris, D.C.
Carex pilulifera, L.
Phleum alpinum, L.
Alopecurus alpinus, Sm.
Lomaria Spicant, Desv.
Phegopteris Dryopteris, Fee.
Lycopodium Selago, L.
L. clavatum, L.
L. alpinum, L.

Betula nana, L.
Narthecium Ossifragum, Huds.
Tofieldia palustris, Huds.
Triglochin palustre, L.
Carex aquatilis, Wahl.
C. rariflora, Sm. Rare.
C. flacca, Schreb.
C. panicea, L.

Summit Vegetation.—One or other of the associations just recorded is traversed in approaching the chief summits of the plateau of the Eastern Grampians. On the summits and ridges there is generally an absence of deep peat with its vegetation, while the *Vaccinium* and many of its associates become dwarfed or disappear. The soil is rocky, but is covered here and there by a thin layer of humus formed chiefly by the decay of the woolly fringe-moss (*Racomitrium lanuginosum*) and other dwarf mountain mosses, and the lichens *Cetraria islandica* and species of *Cladonia*. On the rocky soil and amongst this humus, a few flowering plants withstand frequent alternations of cold and heat, moisture and drought, and all the extremes of the summit climate. This vegetation occurs about 3000 feet, but on exposed parts it may extend down to the 2750 feet contour-line. The following plants are recorded from the summits of Glas Maol (3500 feet) Monega (2917 feet) in Caenlochan, and the Snub and other summits above Clova (about 2750 feet):—

Alchemilla alpina, L.
Potentilla Sibbaldi, Hall, *fil.*
Gnaphalium supinum, L.
Loiseleuria procumbens, Desv.
Empetrum nigrum, L.
Salix herbacea, L.
Juncus trifidus, L.
Carex rigida, Good.
Festuca ovina, L.
Lycopodium Selago, L.
L. alpinum, L.

Alpine crags and rocks.—The characteristic alpine plants occur chiefly in small deposits of soil amongst sheltered crags and wet rocks, where emerging springs keep up a constant moisture. The majority of the following species were observed above the Caenlochan forest (about 3000 feet) and amongst the crags above Clova:—

Thalictrum alpinum, L.
Draba incana, L.
Gentiana nivalis, L.
Veronica alpina, L.

Cochlearia alpina, Wats.
Silene acaulis, L.
Cerastium alpinum, L.
Sagina nodosa, Fenzl.
Dryas octopetala, L.
[Chiefly on calcareous rocks].
Potentilla rubens, Vill.
P. procumbens, Sibth.
Saxifraga oppositifolia, L.
S. stellaris, L.
S. aizoides, L.
S. hypnoides, L.
Chrysosplenium oppositifolium, L.
Sedum roseum, Scop.
Epilobium alsinefolium, L.
E. anagallidifolium, Lam.
Galium boreale, L.
Erigeron alpinum, L.
Saussurea alpina, D.C.
Mulgedium alpinum, Less. Rare.
V. serpyllifolia (humifusa, Dickson).
V. fruticans, Jacq.
Pinguicula vulgaris, L.
Armeria maritima, L.
Oxyria digyna, Hill.
Salix Arbuscula, L.
S. lanata, L.
S. Myrsinites, L.
S. reticulata.
S. Lapponum, L.
Tofieldia palustris, Huds.
Carex atrata, L.
C. flava, L.
C. capillaris, L.
Phleum alpinum, L.
Alopecurus alpinus, Sm.
Poa alpina, L.
Nardus stricta, L.
Polystichum Lonchitis, Roth.
Selaginella selaginoides, Gray.

The Maritime Region.

The irregular coast-line of Forfar and Fife is favourable to the vegetation of this region, which was only briefly referred to in the part dealing with the Edinburgh District. This vegetation, though represented by a single colour because of the scale of the maps is—like the

Fig. 9.—Cliffs and Coves on the coast of Forfar between Arbroath and Auchmithie.
(Reproduced by permission from photo by Messrs. J. Valentine and Sons, Ltd., Dundee.)

sea-coast—by no means uniform. The sea in some parts wastes the coast and lays bare the rocks up to high-water mark, or undermining the rocks it may excavate the land back and form a line of cliffs. The material removed in one part is deposited in another in the form of sand

or mud. The rocky shore, the sandy dunes, and the muddy salt marsh, each has its own vegetation.

1. *Vegetation of Cliffs and Rocks.*—This occurs along most of the coast of the south and east of Fife, and in Forfar from Arbroath to Montrose (Fig. 9). Natural associations are formed according as the plants live submerged or periodically submerged in sea water, or on the land above high water. The marine rock-vegetation consists of algæ definitely distributed. The brown sea-weeds so typical of the beach between high and low tide-limit are especially good examples of social algæ, some of the species of *Fucus* and *Laminaria* occupying well-defined areas. A survey of this kind would yield results of considerable value, but it does not come within the scope of our paper, which is only a primary analysis.

The land vegetation of the sea-cliffs of Forfar and Fife is rich and varied. According to position, the plants have to obtain a footing on almost bare rock; in the loose soil in crevices, or on talus where frequently exposed to drought; or in more sheltered nooks where the débris has weathered into a moist soil in which shade-loving and moisture-demanding plants can flourish. The atmospheric conditions on the cliffs are fairly moist owing to cool breezes and the frequency of fog or rain, but, where the vegetation is exposed to wind and salt spray, plants occur with xerophytic characters adapted to intermittent periods of drought. The most distinct types of plants present on the cliffs are:—(*a*) Maritime plants; (*b*) Maritime-montane plants; (*c*) Plants of the dry hill pasture; (*d*) Plants of the wooded shady stream-side or den.

The following plants have been found from Lunan Bay to Arbroath, and again on the Fife cliffs:—

A. Maritime Plants.

Ligusticum scoticum, L.
Plantago Coronopus, L.
Asplenium marinum, L.

B. Maritime and Montane Plants.

Cochlearia officinalis, L.
Silene maritima, With.
Armeria maritima, Willd.
Plantago maritima, L.

C. Plants of Dry Grassy Pasture.

Cardamine hirsuta, L.
Helianthemum Chamæcistus, Mill.
Polygala vulgaris, L.
Dianthus deltoides, L.
Stellaria Holostea, L. Also Den.
Geranium sanguineum, L.
Anthyllis Vulneraria, L.
Lotus corniculatus, L.
Astragalus danicus, Retz.
A. glycyphyllos, L.
Agrimonia Eupatoria, L.
Sedum acre, L.
Carlina vulgaris, L.
Campanula glomerata, L.
Primula veris, L.
Gentiana campestris, L.
Allium vineale, L.
Anthoxanthum odoratum, L.
Koeleria cristata, Pers.
Festuca, spp.
Polypodium vulgare, L.

D. Den Plants.

Lychnis dioica, L.
Geranium pratense, L.
Vicia sylvatica, L.
V. sepium, L.
Geum rivale, L.
Saxifraga granulata, L.
Valeriana sambucifolia, Willd.
Eupatorium cannabinum, L.
Primula acaulis, L.
Nepeta Glechoma, Benth.
Orchis mascula, L.
Scilla festalis, Sal.
Luzula maxima, D.C.
Bromus giganteus, L.
Brachypodium gracile, Beauv.
Scolopendrium vulgare, Symons.

Typical halophytes (*i.e.* plants adapted for life in an environment where the presence of common salt influences plant-growth) are not conspicuous on the cliffs, but the beach and rocks at the base offer here and there the conditions suitable for plants which occur on sands and salt marshes. *Pneumaria* (*Mertensia*) *maritima*, Hill., is found in a few stations on shingle beach. An interesting feature is the occurrence of cliff plants which occur again in the mountains but are only sparingly present along the river banks in the intermediate zone. The presence of plants of the dry hill pasture of the knolls and scars of the Sidlaws and Ochils is in part explained by the fact that the cliffs are due to the abutting of branches of these ranges on the coast. The majority of them occur in Yorkshire (1903 B) on the dry soils of the Mountain and

Fig. 10.—Sand Dunes, Lunan Bay. The middle portion shows the dune vegetation bounded by a high ridge; seaward this falls rapidly to a sandy beach without vegetation; landwards, the ridge falls into a series of hollows frequently flooded by the River Lunan. The background shows cliffs extending nearly to Montrose.

(*Reproduced by permission from photo by Messrs. J. Valentine and Sons, Ltd., Dundee.*)

Permian Limestones, and are less frequent on the poorer and moister soils of the Millstone Grit Sandstones. The plants of the den are carried to the coast by the streams, and they find sheltered and moist places suited for their growth, although trees are rare on the cliffs. The vegetation of the maritime cliffs is again met with on rocky banks of the Tay estuary. The majority of the plants named are (or were) found at Harecraigs (east of Dundee), Wills Braes (west of Dundee), and on the Fife shore at Tayport, all places where railway works and other influences of man are rapidly exterminating an interesting flora.

2. *Vegetation of Sandy Shores and Sand-Dunes.*—Excellent examples of this vegetation are found in Forfar and Fife. The places least disturbed by man are Tentsmoor and the Sands of Barry, extensive deposits on either side of the mouth of the Tay, both of which have been fre-

quently examined during this survey. Other examples occur at Largo Bay, St. Andrews, Easthaven, Arbroath, Lunan Bay (see Fig. 10), and Montrose.

The general features of Tentsmoor are typical of most of our sand-dunes. It consists of sand except near Tayport and at the mouth of the River Eden at Guardbridge, where there are small tracts of muddy salt marsh. The sand above high-water limit forms a series of interrupted ridges parallel or slightly inclined to the coast-line. From Tayport eastwards, the ridges lie almost south-west and north-east and extend inland for a considerable distance. At Tentsmoor Point they bend round following the coast-line, and the number of distinct ridges becomes

FIG. 11.—Tentsmoor. Sandy Beach passing into Sand Dune. The first vegetation is a loose covering of maritime grasses.
(*Photograph by Robert Smith.*)

reduced to two or three. Behind the first series of loose dune ridges, the moor becomes undulating or almost level, and assumes the condition of fixed dunes. These, on Tentsmoor, are generally covered with a grassy turf, but on the northern side heather and its associates occupy considerable areas (see Map). Here and there the hollows of the moor are bogs or marshes.

The fixed sand-dunes in the present area are grass heaths (except the part of Tentsmoor just referred to), and the gradual development of this vegetation may be frequently observed. The dunes near Monifieth have received most attention in this direction. The chief orographical feature of a sand-dune is an alternation of ridge and hollow. Winds and sea-currents are the most important factors in the formation of the ridges, for one can trace their commencement in those low spits or

ridges of sand running obliquely into the sea below high-water mark, and on which one may walk dry-shod after the rising tide has flowed into the hollow between the spit and the shore. The ridges are formed where deposition of sand is taking place, and not where the coast-line is being denuded; this we have observed at Monifieth where one stretch of the sands is forming, while the fixed dunes less than a mile off are being wasted. Vegetation soon begins to play a part in the building up of the ridge, and the first plants may be found on ridges which are still liable to inundation in the highest or spring tides. The sea-couch grass (*Agropyron junceum*) and the sand sedge (*Carex arenaria*) are generally the first colonists; both are adapted by their long creeping underground stems and by their tenacity of life to play this part (Fig. 11). The lyme grass (*Elymus*) and the sand bent (*Ammophila* or *Psamma*) soon follow. Round their first scattered tussocks blown sand rapidly becomes heaped up, but the shoots are not easily suppressed and can be found at depths of many inches giving rise to new shoots which find their way to the surface. The binding action of these plants gradually increases the size of the dune ridge and makes it permanent. At the same time the plant covering becomes augmented and forms a closer association. The following are plants of this open vegetation of the loose sand-dunes:—

Ammophila arundinacea,	Host.	Dominant.	*Arenaria peploides*, L.
Elymus arenarius, L.		„	*Lotus corniculatus*, L.
Agropyron junceum, Beauv.		„	*Ononis repens*, L.
Carex arenaria, L.		„	*Trifolium repens*, L.
			Potentilla Anserina, L.
			Cnicus arvensis, Hoffm.
			Glyceria maritima, Mert. and Koch.

Thistles, docks, and other plants of fields and recently disturbed ground also find a place. *Eryngium maritimum*, L., and *Volvulus Soldanella*, Jung., are rare plants occurring in this association. Plants of a different type occur just above high-water mark along the base of the ridges still liable to inundation by sea water. The most abundant of these strand-plants are:—*Cakile maritima*, Scop., *Salsola Kali*, L., and *Atriplex Babingtonii*, all annual plants, small-leaved, fleshy in texture, recumbent in habit, with their branches spreading over the sand.

The hollows or troughs between the dune ridges nearest the sea are sandy flats devoid of vegetation and still liable to inundation at high tide. When completely enclosed by protecting ridges, the dune hollows become occasional pools of rain water where fine dust and organic materials collect. The catch-water has as its first vegetation evanescent growths of slimy blue-green and green algæ, which aid in consolidating the bottom and add to the organic matter, till the soil is impervious enough to retain water throughout the winter and spring. Pools of this kind soon prepare a substratum moist enough for certain mosses, and these in turn prepare a soil dark in colour, firm and retentive of moisture as compared with the original sand. In time the hollows become covered with a close sward of plants, and form dark green depressions surrounded by sandy ridges as yet only loosely covered with glaucous green sand-

binding grasses. The later vegetation of the dune hollows depends on the drainage. Where this is good grasses are the dominant element; where water accumulates sedges and marsh plants prevail, and between the two extremes one finds every stage of transition. The vegetation of the dune hollow forms a nucleus for the conversion of the loose sandy ridges into fixed dunes. As one passes inland from the dunes thinly covered with maritime grasses, there is an increase in plants forming an undergrowth easily distinguished by its fresh green colour strongly contrasting with the glaucous sand-grasses. The more important of the sward-forming plants are :—

Festuca rubra, L.
Agrostis palustris, Huds.
Glyceria maritima, Mert and Koch.
Lolium perenne, L.
Lotus corniculatus, L.
Trifolium repens, L.
Astragalus danicus, Retz.
Ononis repens, L.
Erodium cicutarium, L'Her.
Equisetum arvense, L.

At a later stage the sward of both ridge and hollow becomes more continuous, but still not so compact as on fixed dunes. The following list made on Tentsmoor illustrates this semi-final stage :—

Ridges, Slopes, and Dry Hollows.	Moist Hollows.
Linum catharticum, L.	*Erica Tetralix*, L.
Erodium cicutarium, L'Her.	*Salix repens*, L.
Astragalus danicus, Retz.	*Stellaria palustris*, Retz.
Trifolium arvense, L.	*Sagina nodosa*, Fenzl.
T. striatum, L.	*S. maritima*, Don.
T. procumbens, L.	*Radiola linoides*, Roth.
T. dubium, Sibth.	*Peplis Portula*, L.
Potentilla Anserina, L.	*Anagallis tenella*, L.
Filago germanica, L.	*Erythræa Centaurium*, Pers.
Calluna Erica, D.C.	*Juncus bufonius*, L.
Erica cinerea, L.	*J. balticus*, Willd.
Carex incurva, Lightf.	*Carex Goodenowii*, Gay.
Phleum arenarium, L.	
Agrostis vulgaris, With.	
Festuca rubra, L.	
Nardus stricta, L.	
Holcus mollis, L.	

The ridges and hollows may be traced far inland on the fixed dunes As a rule a considerable amount of levelling takes place. This is in part the result of wind and rain, but rabbits frequently assist in the process. The sand thrown out from the burrows finds its way downward into the hollows, and in time the ridge becoming undermined gradually collapses. The vegetation of a gently undulating fixed dune is in many respects that of a dry hill-pasture. The following were observed on the level grassy part of Tentsmoor far from any cultivation, and may be taken as a representative list :—

Erophila vulgaris, D.C.
Teesdalia nudicaulis, R. Br.
Veronica arvensis, L.
V. serpyllifolia, L.

Polygala vulgaris, L.
Cerastium arvense, L.
Ulex europæus, L. Dwarf.
Medicago lupulina, L.
Trifolium repens, L.
Potentilla silvestris, Neck.
Galium saxatile, L.
G. verum, L.
Achillea Millefolium, L.
Chrysanthemum Leucanthemum, L.
Senecio Jacobea, L.
Leontodon autumnalis, L.
Hieracium Pilosella, L.
Calluna Erica, D.C. Not abundant.
Erica cinerea, L.
E. Tetralix, L.
Gentiana campestris, L.
G. Amarella, L.
Thymus Serpyllum, Fr.
V. officinalis, L.
V. Chamædrys, L.
Plantago lanceolata, L.
P. maritima, L.
Rumex Acetosa, L.
R. Acetosella, L.
Habenaria viridis, R. Br.
Luzula campestris, D.C.
Carex arenaria, L.
Anthoxanthum odoratum, L.
Aira caryophyllea, L.
A. præcox, L.
Holcus mollis, L.
Dactylis glomerata, L.
Koeleria cristata, Pers.
Festuca ovina, L.
F. rubra, L.
Lolium perenne, L.
Botrychium Lunaria, Sw.

Corallorhiza innata, Br., the parasitic coral-root, occurs in one place near the centre of the moor.

The heather vegetation is a feature of the sand-dunes of the northern side of Tentsmoor. Here the transition from loose dunes to heather moor is rapid. The ling (*Calluna*) appears first in the moist dune-hollows accompanied by *Erica tetralix*, *Salix repens*, and other plants of the moist hollow (see above). Near the sea the ling is small but retains its place with considerable persistence, and, though frequently buried in drifting sand, the twigs push their way upwards and emerge. Further inland the hollows become more swampy in character, and more exclusively occupied by *Erica Tetralix*. On the lower slopes of the ridges *Salix repens* is characteristic, while *Calluna* and *Erica cinerea* occur towards the crest of the ridges. The hollows further inland in many cases have become swampy: the plants are those of the marsh, or the bog, with a few aquatics, and the vegetation as a whole is that of water which is fresh or only slightly brackish (Fig. 12). The deep drains cut in the moor suggest that at one time the swamps were extensive, and as a considerable variety of fresh-water aquatic plants occurs, it is also probable that the swamps were formerly occupied to a greater extent by that type of plant. The drier part of the moor still shows traces of the ridge and hollow of the sand-dunes, but considerable levelling has taken place. Heather (*Calluna*) covers it closely, attaining a height of from one to two feet, and along with it one finds the majority of the plants present with heather on the hill moors. This part is a grouse preserve, and doubtless regular firing and care has fostered the growth of the heather. On the landward side of the heather there are several woods of Scots pine and birch, some of which have been planted, but, as pointed out by Robert Smith (1900 A) many seedlings from these can be found on the moor.

Tentsmoor and the Sands of Barry are still at the present time fairly primitive dunes. Yet here small farms have long been established on the central inland parts, and crops of oats, rye, carrots, and potatoes grew well. Within recent years these farms have mostly been laid down in grass. The tenants have also grazing rights on the dunes, and sheep have played a part in producing the present vegetation; they are probably the chief factor in determining the scarcity of heather on the dunes generally. This plant is, however, much more abundant than might be gathered from a casual examination. Towns and villages have also encroached on the inland parts of the fixed dunes. The golf links of St. Andrews, Elie, Monifieth, Carnoustie, and Montrose are fixed

FIG. 12.—Tentsmoor, near the Point. A drain with marsh vegetation. The background is heather-covered fixed dune.
(*Photograph by Robert Smith.*)

dunes, and this use tends to foster the grass association, while heather and swamp are almost suppressed.

(3) *Vegetation of Muddy Shores.*—The conditions necessary for the deposition of mud are eddying currents, by which the finer particles separated from the coarser sand are deposited under still-water conditions. The mud-flats are almost always found near the mouth of an inflowing stream, and not far from sand-dunes. They are also more extensive in the tidal estuary of a large river like the Tay than on the open coast of the North Sea. Typical, but not large, examples occur near the mouth of the Eden at Guardbridge; in the Tay estuary where streams enter at Tayport, Balmerino, Kingoodie, and Invergowrie; and in the Montrose Basin. The vegetation of the muddy salt marsh is distinct from that of the sand-dunes. Near Tayport, between Tentsmoor and a small island—Luckie Scaup—*Zostera marina* (a flowering

plant) is common on rocks in the mud between high and low water. Gardiner (1848) mentions this plant in Montrose Basin, and as rare near Monifieth. The greater number of the salt-marsh plants occur in tidal estuaries where submerged only by the highest tides. Amongst them are typical halophytes with small leaves, fleshy stems, and other adaptations to life within the influence of salt water (Warming, 1896). The more important in this area are:—

Suæda marina, Dum.
Aster Tripolium, L.
Glaux maritima, L.
Armeria maritima, Willd.
Plantago maritima, L.
Salicornia herbacea, L.
Juncus Gerardi, Lois.
Triglochin maritimum, L.
Scirpus maritimus, L.
Carex extensa, Good.
Agrostis maritima, Mey.
Glyceria maritima, Mert. and Koch.

The following occur on the coast of Forfar near Montrose, but were not observed on Tentsmoor:—*Suæda maritima*, *Carex vulpina*, and *C. distans*.

The Estuary of the Tay.—The river marshes at Kingoodie (west of Dundee) and Balmerino (at the southern end of the Tay Bridge), may be said to mark the limits of the maritime vegetation. Up to this limit maritime plants are not uncommon. At Invergowrie, Kingoodie, and Balmerino, almost all the plants of the muddy salt marsh may be found along with plants like *Caltha palustris* and *Ranunculus sceleratus*, which, though typical fresh-water marsh plants, seem able to exist with occasional submergence at high tides in the brackish water of the estuary. Dr. Buchanan White (1898) gives Kingoodie as the most inland station for several of the salt-marsh plants. Others occur as far up as the mouth of the River Earn, where Dr. White (p. 316) says "the water is brackish only when the river is low." Dr. H. R. Mill (1893) gives near Newburgh as the upper limit of the sea-water.

That few maritime plants occur above this is shown by an examination of Mr. Barclay's lists of plants (1890 and 1891) observed on the marshes of the Tay from Perth downwards to the mouth of the Earn. From the junction of the Earn and Tay downwards to near the Tay Bridge is thus the estuarine or intermediate area. The right or southern bank is fairly steep, and is either cultivated or wooded to the river edge; the deep channel of the river lies close to this bank, and there is little room for marshes. The left bank,[1] as the map shows, is the extensive alluvial deposit of the Carse of Gowrie, and is fringed with marshes. This bank is also bounded for the greater part of the way between Cairnie Pier and Kingoodie by a comparatively steep bank which is more or less thickly wooded. Between this bank and the channel of the river is a wide extent of marsh and swamp, formed chiefly of mud deposited by the river. The most striking feature of this tract is the broad belt of *Phragmites communis*, which extends in an almost unbroken line from below Cairnie Pier to the mouth of the

[1] Mr. Barclay has recently surveyed this bank and contributes this part of the description from his notes. A more detailed account is given in his recent paper (1904).

Huntly Burn (about twelve miles). This bed of reeds, at Errol and for a considerable distance below, comes so close to the bank that there is no room between them for any other vegetation. Towards Seaside the reeds begin to recede at intervals from the bank, leaving space for a tract of firmer but still marshy ground, bordered here and there on the inner side by scattered clumps of *Juncus glaucus* and dotted over with patches of *Carex vulpina*. It is not, however, till some distance after the Pow is crossed at Powgavie that this marsh becomes continuous, and gradually broadens out towards the termination of the reed belt at Huntly Burn. On the outer side of the reed belt, next to the river, there is at Errol a tract of softer mud, which is, at this point, only partially occupied by patches of *Scirpus maritimus* and *Scirpus Tabernæmontani*. Further down these plants occupy more and more of the mud, until they become a broad belt on the outer side of the reed belt. This latter is thus narrowed more and more between the inner marsh and the outer sedge belt, until it terminates and the other two become adjacent near Kingoodie. This distribution of the vegetation seems to be due to the greater or less consolidation of the mud-floor, or what comes to much the same thing, its greater or less elevation above the level of the river.

In the inner marsh, *Juncus Gerardi* is abundant from about Seaside downwards, and between the Huntly Burn and Kingoodie it is the dominant plant over large spaces. *Aster Tripolium* (another maritime plant) occurs occasionally over the same stretch. *Buda marina*, *Glaux maritima*, *Sagina maritima*, and *Plantago Coronopus* either have their upper limit at Kingoodie, or become very rare to the west of it. It is curious that *Arenaria peploides*, which occurs on the south bank as far up as Balnabriech, should be entirely absent on the north bank. The following list includes the more characteristic plants occurring between Cairnie Pier and Kingoodie. It does not include those of the river bank proper which belong to the vegetation of the shady den :—

Scirpus maritimus, L. Dominant.
S. Tabernæmontani, Gmel. „
Phragmites communis, Trin. „
Juncus Gerardi, Lois. Dominant locally.
Ranunculus sceleratus, L.
Caltha palustris, L.
Œnanthe fistulosa, L.
Œ. crocata, L.
Eupatorium cannabinum, L. Rare.
Aster Tripolium, L.
Pedicularis palustris, L.
Lycopus europæus, L. Rare.
Rumex conglomeratus, Murr.
Juncus effusus, L.
Juncus glaucus, Ehrh.
J. acutifolius. Ehrh.
Butomus umbellatus, L. Rare.
Eleocharis palustris, R. Br.
E. uniglumis, Reichb.
Carex vulpina, L.
Agrostis palustris, Huds.
Alopecurus geniculatus, L.
Catabrosa aquatica, Beauv. Rather rare.
Glyceria fluitans, R. Br.
G. plicata, Fr.
G. maritima, Mert. and Koch (up to Powgavie).

The Vegetation of Lochs, Marshes, and Bogs.

This is an important feature of the area, although it is so distributed that it cannot be adequately represented on the maps. Many observa-

tions made in the districts of Edinburgh and Northern Perthshire were not fully dealt with in these papers, because Forfar and Fife were required to provide a continuous area. Since water is the prime factor in determining the plant associations of lochs, marshes, and bogs, its relation to vegetation may be summarised.

(*a*) *Water Supply.*—The maintenance of a constant supply of fresh water is fairly well assured in Britain. The annual rainfall is moderately large, and, what is more important, it is almost equally distributed throughout the year, so that there are rarely long periods of drought or continuous frosts. Graebner (1901) in dealing with the vegetation of the North German Plain shows clearly that the Atlantic (or British) type of climate favours a vegetation very distinct from that of the European Continental climate. Thus the ling or heather is confined to the Atlantic climate area, and is absent from the continental area. The heather is a typical British plant, and we may adopt Graebner's conclusions that it is associated with the climate just outlined. The disposition of the rainfall in the form of lakes, streams, or wet places depends on the configuration of the surface of the land. A single example will suffice to show this: the area of Perth and Forfar has many lochs when compared with the almost equal area reduced to botanical maps in Yorkshire, yet the rainfall is so nearly similar that an explanation from this aspect is debarred; the contrast arises partly from the large drainage-area due to the greater altitude of the land in the Grampians, and partly (as suggested by Professor P. F. Kendall) from the greater erosion of the Grampians in the Glacial period, by which deep troughs were cut in many places. The edaphic conditions determine the distribution of water, and therefore of plants which grow in or near water. Dr. Warming (1896) has demonstrated that the distribution of all plants is largely determined by the water supply, and in a less degree by the available food-materials. In the case of plants growing in aquatic, marsh, or bog conditions it also appears that the water supply is the important factor. The mineral matter in different waters varies, but Warming says it has not yet been proved that this variation has any marked effect in the distribution of water vegetation. There is, however, evidence that water with dissolved food-material supports the richest variety, and that "soft" water poor in salts has a less varied vegetation. This is dealt with later (see p. 83).

(*b*) *Movement of Water.*—Aquatic plants depend on moving water for supplies of mineral food. Submerged plants further derive oxygen and carbonic acid gas from water; hence they occur mainly in water which is often renewed. Many aquatics with floating or aerial leaves, and plants of the marsh and bog, grow on stagnant muddy bottoms where organic acids, marsh gas, etc., abound, and where oxygen is deficient; in this case the exposure of the leaves to the atmosphere enables the submerged parts to exist in stagnant conditions. The rate of movement has also considerable influence. Thus some plants require running water, while others occur in the slowly moving water of a lake or pool. The course of a stream presents different degrees in the rapidity of its flow, and there is a correlated difference in its vegetation.

The moorland gathering grounds are cut up by streamlets which frequently flow into an upland bog, or, as in the Grampians, into a system of highland lochs. Between the upland gathering grounds and the lowlands the stream passes through a zone of rapid descent, through ravines or gorges the rocky banks of which are frequently clad with trees. Small marshy places may occur here, but they are subject to fairly rapid drainage. In the lowlands of Forfar and Fife many of the streams are feeders of large lochs where the water flows slowly, and it is here the best development of aquatic vegetation occurs. The river from the loch to the sea, according to the geology of the district, flows either through rocky ravines or through alluvial flats favourable to the formation of marshes.

(*c*) *Temperature of Water.*—The aquatic vegetation is best developed

Fig. 13.—The Long Loch at Lundie from the south-west end. The shores are bare and devoid of any reed-swamp. A pine wood extends along one bank.

(*Photograph by Robert Smith.*)

where the quantity of water is sufficiently large to maintain a fairly constant temperature throughout the year. Almost all aquatic plants are herbaceous perennials with their hibernating stems and other parts immersed in the bottom of lakes or pools where the water does not freeze. Many annual aquatics (e.g. *Utricularia*, *Hottonia* and *Hydrocharis*) hibernate by buds which become detached and sink to the bottom. The effect of temperature on the vegetation of lochs, marshes, and bogs requires investigation both as to winter and summer conditions. Kerner (1855) made an interesting suggestion that the upper temperature limit determines the distribution of certain water plants in the Alps. Thus *Montia fontana* and *Stellaria uliginosa* he found only where the water did not exceed 8·2° C.; *Veronica Beccabunga* not above 9·8° C.; *Glyceria aquatica* not above 10·5° C. (51° F.); and *Lemna trisulca* up to 11° C.

Water plants have long been recognised in works on the British Flora as hygrophiles, or by Warming's name of hydrophytes. No great

experience amongst them is required to recognise that the hydrophytes are not all equally hydrophytic. Between water plants and land plants there is every stage of transition, and every variation in the distribution of water provides conditions suitable for some association of plants. As a first step in the analysis of this vegetation we may distinguish the true aquatic associations from those of the marsh and bog. The former can only be developed where there is permanent submergence in water. Marshes and bogs are formed where the substratum alternates between lengthened periods of submergence under water, and shorter periods of a condition more or less resembling dry land. These conditions exist in the basins of streams liable to periodic rise and fall, or in hollows where

FIG. 14.—Methven Loch. The shores are fringed by the tall reed-swamp, seen against the trees. The rush marsh is on the landward side of the reed-swamp, and a drier marshy vegetation occupies the foreground. The loch is frequented during the nesting season by numerous seagulls, seen in flight.

(*Photograph by Robert Smith.*)

water accumulates during a rainy season and is slowly removed by evaporation. Marshes and bogs in Britain occupy soils which are waterlogged from the commencement of the autumn or winter rains till the following summer, and even during the drier season they are liable to frequent shorter periods of flooding and drying. The characteristic feature of the plants of marsh or bog is that on the one hand their roots and other parts buried in the substratum show adaptation to a life in water, while, on the other hand, their aerial parts either resemble those of mesophytic land-plants, or they assume the form of reduced leaves and other adaptations suited to periods of drought. For fuller details of these adaptations of structure, some of the special works on plant ecology should be referred to (*e.g.* Schimper, 1903; Warming, 1896, etc.). The distinction of fresh-water aquatic associations from those peculiar to marshes and bogs is based on the one hand on differences

in substratum, on the other hand on differences in the type of plant. The distinction between the plant associations of marsh and bog is referred to later.

Fresh-Water Aquatic Vegetation.

The plant associations which make up this vegetation occur chiefly in the lochs, although smaller areas may be found in ponds and other

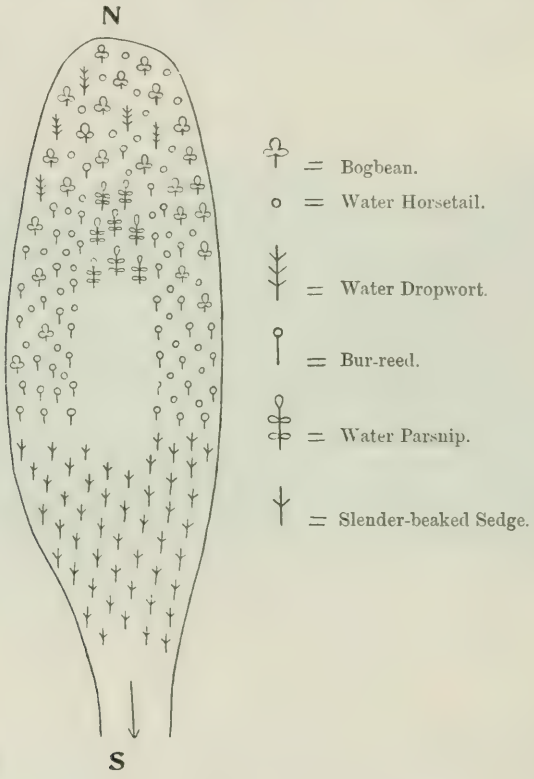


Fig. 15.—The Bog-bean Pond. The pond always contains water from springs; the arrow indicates the outflow. The deepest part is free from vegetation.—(W. G. Smith.)

small patches of water. The plants themselves are hydrophytes, adapted by external form and internal structure to an existence in water. These adaptations have frequently been described in recent literature (*e.g.* Schimper, 1903; Warming, 1896; Goebel, 1893; Boulger, 1900, etc.). It is generally accepted that plants inhabiting fresh water have a wide geographical range, and the present area offers opportunities for examining this to some extent. It is a feature of the lochs of Perth and Forfar that they occur in two fairly distinct zones, a lowland series situated in the lowland valleys, and a highland series in the mountains. Mr. Abram

Sturrock (1880), who knew these lochs well, distinguishes between the lowland loch and the highland loch. His chief distinction of the highland loch is the presence of three plants : *Subularia aquatica*, *Lobelia Dortmanna*, and *Isoetes lacustris*. R. Smith adopted Sturrock's distinctions and carried them further. They may be given in the form of an extract from an article comparing two lochs of the Sidlaws at Lundie (near Newtyle):—"The Long Loch and the Round Loch, although only about one mile apart, are as different in type as if one had been in the highlands

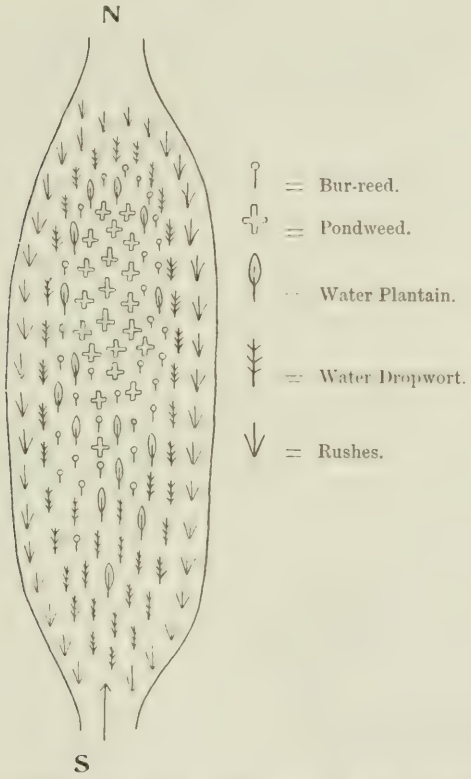


Fig. 16.—The Pondweed and Water Plantain Pond. Water supplied by springs, and during rains by an inflow stream (*see* arrow). The broad rush belt is dry when the pond is low ; the pondweed area probably always contains water.—(W. G. Smith.)

and the other in the lowlands. The Long Loch lies up in the hills (720 feet) in a hollow of igneous rock (Fig. 13). Its shores are treeless except for a plantation of spruce on the south side. The vegetation of the margin is small and stunted. In the water is a well-marked highland plant—*Lobelia Dortmanna*. The Round Loch, on the contrary, lies amongst pasture and arable land (about 650 feet), with lowland trees and shrubs on its northern shore. Its foundation is sand and gravel of glacial drift, and with this its lowland nature is connected. Flowers are

not conspicuous, but the shores are obscured by beds of rush, reed-grass, iris, bur-reed, mare's tail, etc., whilst the surface of the water bears the floating leaves and cups of the white water-lily. . . . We have, between Clunie Loch and Rescobie Loch, the same contrast that we had between the Long Loch and the Round Loch at Lundie. But Rescobie has the lowland character much more marked than the Round Loch."—(*Dundee Advertiser*, July 4, 1896.) The last passage of the above refers to Rescobie Loch near Forfar, and to Clunie Loch, one of the chain extending from Blairgowrie to Dunkeld. It is a confirmation of Mr. Sturrock's conclusion that Rescobie is a lowland loch, while Clunie and others to the west of it are of the highland type, though actually not much higher above the sea. Mr. Barclay has re-examined the Dunkeld to Blairgowrie chain of lochs, and he adds:—"Marlee is much more a highland loch, like Clunie, than a lowland loch. Its shores, except at one or two places, are not marshy to any great extent, and *Subularia* and *Lobelia* both occur in it. The small Rae Loch near Marlee (to the east) is different, and is, I should say, lowland in type, nearly inaccessible in most places on account of the tall reeds, sedges, etc."

Lowland Lochs.—Good examples of these occur in the area. The aquatic vegetation of the Rescobie group of lochs near the town of Forfar has attracted many botanists, including Messrs. G. Don, W. Gardiner, A. Sturrock, and J. Knox. The Perthshire group which includes Clunie, Marlee, and Rae Loch, is also well known. Loch Leven and several smaller lochs occur in Fife and Kinross. In lochs of this type the social species occupy definite places. Free-floating plants like *Utricularia* and the water soldier (*Stratiotes*) are found in still pools (*e.g.* "pot holes") near Rescobie Loch.[1] The submerged, rooted pondweeds (*Potamogeton*) occur in deep water which is in movement. The water lilies with floating leaves form a zone nearer the land; their rhizomes and roots, rarely found within wading depth, are submerged in slimy mud rich in marsh gas. In somewhat shallower water may be found the submerged *Myriophyllum* and *Zannichellia*. Still nearer the shore, *Callitriche* and *Littorella* occupy places which are liable to be left dry for short periods. The mare's tail (*Hippuris*) frequents shallow still parts with a muddy bottom. The shores of lowland lochs have a more or less continuous reed-swamp of tall plants with long narrow leaves, including reeds, rushes, sedges and grasses. Behind the reed-swamp there is a marsh which may be traversed dry-shod in summer; here the prevailing vegetation is lower than the reed-swamp, although thickets of willow and alder may occur (Fig. 14).

The distribution of the chief species in a loch is sharply enough defined to be reduced to charts. My brother had begun a survey of this kind for Rescobie, but unfortunately it is not complete enough for publication. Two examples of charts are here reproduced (Figs. 15 and 16) from observations made on two small ponds in Yorkshire (*Naturalist*, October 1903).

The representative, and some of the rarer, flowering plants from the Rescobie and Marlee Lochs (each about 200 feet above the sea) are given in the following tables. The loch plants found in the marshes on the

[1] From these pot-holes and other places near the loch, marl was formerly excavated and used for improving the agricultural land.

banks of the Tay near the mouth of the Earn are given to show how strongly the reed-swamp plants are represented.

A.—Rooted Plants, with Submerged or Floating Leaves, in Deep or Shallow Water.

× presence, – absence of the species.

	Rescobie Lochs.	Marlee Lochs.	Tay Marshes.
Ranunculus hederaceus, L.	×	×	×
R. heterophyllus, Web.	×	×	
Castalia speciosa, Sal.	×		
Nymphæa lutea, L.	×	×	
Subularia aquatica, L.	×		
Hippuris vulgaris, L.	×	×	
Myriophyllum spicatum, L.	×	×	×
Callitriche, spp.	×	×	×
Lobelia Dortmanna, L.	×	×	
Littorella juncea, Berg.	×	×	
Polygonum amphibium, L.	×	×	×
P. Hydropiper, L.	×	×	×
Potamogeton natans, L.	×	×	×
P. polygonifolius, Pour.	×	×	
P. heterophyllus, Schreb.	×	×	–
P. lucens, L.	×	×	×
P. prælongus, Wulf.	×	×	
P. crispus, L.	×	×	
P. pectinatus, L.	×	×	
P. obtusifolius, M. and K.	×	×	
Zannichellia palustris, L.	×		
Naias flexilis, R. and S.	×	×	
Glyceria fluitans, R. Br.	×	×	×
Chara, spp.	×	×	×

B.—Plants of the Reed Swamp.

	Rescobie Lochs.	Marlee Lochs.	Tay Marshes.
Ranunculus Lingua, *L.*	×	–	–
Lythrum Salicaria, L.	×	×	×
Epilobium hirsutum, L.	×	×	×
Lysimachia thyrsiflora, Sit.	×	×	×
Iris Pseudacorus, L.	×	–	×
Typha latifolia, L.	×	×	×
Sparganium ramosum, Huds.	×	×	×
S. simplex, Huds.	×	–	×
Alisma Plantago-aquatica, L.	×	×	×
Butomus umbellatus, L.	–	×	×
Scirpus lacustris, L.	×	×	×
Phalaris arundinacea, L.	×	×	×
Phragmites communis, Trin.	×	×	×
Glyceria aquatica, Sm.	×	–	×
Equisetum limosum, Sm.	×	×	×
E. palustre, L.	×	×	
Carex rostrata, St.	×	×	×

Highland Lochs.—The reed-swamp so characteristic of the lowland loch is represented on the shores of a highland loch by a fringe of rushes and sedges, which rarely attain the density or the height of the reed-swamp plants. The species which occur in the water are fewer in number than the lowland loch; this will be seen from notes taken. The Long Loch at Lundie (700 feet) has *Subularia aquatica*, *Lobelia Dortmanna*, *Littorella juncea*, *Polygonum Hydropiper*, *Potamogeton lucens*, *P. prælongus*, *P. heterophyllus*, as submerged plants; while *Alisma plantago* and *Sparganium natans*, with rushes and sedges, constitute a scanty reed swamp in one place only. The Black Loch (900 feet) in the Cleish Hills (Kinross) contains—the yellow water lily (*Nymphæa lutea*) and *Potamogeton prælongus* in deep water at the western end, with horsetail (*Equisetum*) nearer the shore; a zone of reeds (*Phragmites communis*) in water at least a foot deep; *Carex rostrata* on the sand and gravel round the margin, with *Juncus acutiflorus* behind it nearer the land; *Littorella juncea* occurs on the flat shingly margins. During the work in Northern Perthshire, R. Smith noted the following in Loch Moraig[1] (1100 feet) near Blair Athole—*Potamogeton polygonifolius*, *Carex rostrata*, *Sparganium natans*, and *Myriophyllum verticillatum* were dominant social forms; one or two species of *Chara* were present either alone in shallow water, or associated with *Myriophyllum* and *Potamogeton prælongus* in deeper water on a muddy bottom: the two latter species occurred again with mare's tail (*Hippuris*) near the inflowing stream; and *Equisetum limosum*, either alone or mixed with *Eq. palustre* formed a miniature reed-swamp. The abundance of the calcareous stonewort (*Chara*) in this loch, and the presence of disused limekilns near it, suggest that the water contains lime salts, which may in part explain the comparatively rich aquatic vegetation in a loch at this altitude. Loch Ordie (1000 feet) in the Athole larch forest contains—*Lobelia Dortmanna*, *Littorella juncea*, *Potamogeton perfoliatus*, *P. natans*, *Juncus supinus*, *Isoetes lacustris*, and *Pilularia globulifera* (taken from *Perth Soc. Nat. Sci. Proceedings*, vol. ii. 1883, p. 113). In Lochanna-Bienne, a small loch at about 1500 feet not far from Loch Ordie, we saw in 1885 the white water lily and the water *Lobelia* in flower. The following were noted in Loch Shechernich (about 1500 feet), between Glen Isla and Glenshee—*Ranunculus aquatilis* (sub-sp.), *Lobelia Dortmanna*, *Potamogeton polygonifolius* (and other species), *Callitriche* sp., *Myriophyllum* sp., *Eleocharis lacustris*, *Isoetes lacustris*, *Chara* sp., and various species of *Carex*. In Loch Brandy (about 2000 feet), near Clova, Gardiner (1848) records *Subularia aquatica*, *Lobelia Dortmanna*, *Isoetes lacustris*, and the water moss (*Fontinalis antipyretica*) (Fig. 17).

Comparing these notes on lowland and highland lochs, it will be seen that many aquatic plants have a wide range in this area. They also confirm Mr. Sturrock's distinction of the highland loch by means of the three plants already mentioned—*Lobelia*, *Subularia*, *Isoetes*, and they also show the absence of the reed-swamp noted by my brother. The distinction between the highland and lowland lochs may be traced in part to

[1] In Sir John Murray's Survey of the Scottish Lochs it is stated that this loch is artificial, since it was formed by the banking up of the south end of an old snipe-marsh.

climate. The lochs at a high altitude are ice-bound during a long winter, and in spring the shores are submerged in melting snow and ice, just when the reed-swamp plants should emerge from hibernation. This does not, however, quite explain the highland character of the vegetation of Clunie and Marlee, which lie at a low elevation and differ little in altitude from the neighbouring Rae Loch and from the Rescobie lochs, which are lowland in type. There is another explanation to consider. Graebner (1901) mentions that in moorland pools of the North German Plain situated at a low altitude in a heather area, he finds *Isoëtes lacustris*, *Lobelia Dortmanna*, *Littorella juncea*, *Potamogeton polygonifolius*, and *Sparganium*, all plants found in our highland lochs. Graebner recognises these as plants growing in water poor in food material, whereas the vegetation of our lowland

FIG. 17.—Loch Brandy. Highland Loch with no reed-swamp.
(*Photograph by J. L. Smith.*)

lochs is regarded by him as that growing in water with a considerable amount of food in solution. All our lowland lochs receive their water with dissolved materials from a large area, whereas the highland type of loch occurs near the head-waters of streams, and therefore does not receive so much plant food. This would apply to Clunie and Marlee, which are supplied directly by hill-streams. It seems, therefore, very probable that the highland loch vegetation is made up of plants which have small requirements for food material. The position of Graebner's area is, however, so far north in Europe that the occurrence of the above plants at low altitudes does not altogether exclude the climatic factor. At present, therefore, while the results of the botanical surveys allow of the distinction of the highland and lowland lochs by their vegetation further observations are required before this can be explained.

(*To be continued.*)

LETTERS FROM MOROCCO.

(*Continued from page* 41.)

From Tangiers to Larash by Sea.

Travelling in Morocco, besides being very costly, presents many difficulties and complications. It is true one can get to Tangiers itself easily enough, but, beyond that, there are as yet few facilities. To reach Ceuta, for example, from Tangiers one must cross to Spain, and there, on the following day, take a boat—an excursion which might easily be made in one day thus occupying four. From Tangiers to Tetuan (fifty kilometres) the journey is even worse. One takes the steamer to Oran, and returns by a boat of the Compagnie Zouache, thus spending fifteen days!

Upon the west coast there are English, French, and German boats, but they are chiefly meant for merchandise, and are very irregular in their movements. One does not know up till the last moment when the boat may sail, nor even where she may stop.

That difficulty solved, at last one manages to get on board and the boat starts, passing at first to the western end of the Straits of Gibraltar and keeping well out from the rocky shore. After some miles the boat turns suddenly south, rounding Cape Spartel. This cape, which the Arabs call "Jebel Ashgar" or "Torry," and the Spaniards name "Farola," is unhappily famous for the great number of shipwrecks which took place here previous to 1864. In that year the representatives of the European Powers compelled the Sultan to erect a large lighthouse, which remains still the only erection of the kind in Morocco. Southwards the coast is formed of low-lying stretches of sand or dunes, where the sea rushes in in long rolls of heavy surf even on the calmest day. These shores are very difficult of approach, more especially as the water is very shallow even at a considerable distance out. The reddish sand continues to the foot of the Fah'c hills, bare and sterile and burnt by the summer heat. This is, indeed, one of the least fertile parts of Morocco. There are, however, a few river mouths, among which the Wad-el-Karrub has a fairly deep estuary. Then we pass the little ruined town of Arzila, with its crumbling walls and houses.

The coast-line rises a little towards Larash, where we arrive after a voyage of between five and six hours. The boat anchors at the mouth of a small bay, at the south of which is the town of Larash, built on the side of a rocky plateau. Our caravan, which has come by land from Tangiers, has arrived before us, but was forced to camp outside the town, as the Caid feared they might be horse-stealers.

There is one isolated fort armed with miserable, ineffective cannons, and some old ruined bastions. Like all the ports on the Atlantic coast, the entrance to Larash is blocked by a sand-bar, here formed by the deposit brought down by the river Lekkus. When the sea is at all rough, it is impossible to cross this barrier, and even in fine weather one has to wait for high tide. One lands at a primitive pier where huge

zinc-covered sheds have lately been erected by English enterprise, much more practical than the ancient dock buildings at Tangiers. All about the pier and shore lie cases and bales of goods destined for the Sultan, most of which will presumably reach him some time, when a caravan happens to come and fetch them. But there are some which seem little likely ever to reach Fez, on account of their weight and bulk; for example, there is an enormous bronze lion, intended no doubt to adorn his palace, but which has remained lying here in its case for months. There are also all the materials for a narrow-gauge railway, which was to have been constructed between Fez and Mequinez, still waiting on at Larash along with a locomotive and two wagons. A contractor of Tangiers once undertook to transport all this baggage to Fez by carts, taking advantage of the dry season when it might be possible to travel on the badly made tracks. But his carts were "held up" fifty kilometres from the sea; he was obliged to return to Larash, and the bronze lion continues to gaze on the sad sea waves through the bars of his case.

Larash is an entirely native town; the narrow, steep streets are as dirty as it is possible for streets to be. To reach the Caid's house we had to cross all manner of filthiness and abominations. In the Kasbah, or upper part of the town, is the *sokko* or market-place, surrounded by white-washed arcades, under which are the usual little dark shops. Two old ruined buildings near at hand are the Palace of the Sultan and the Palace of the Pasha. But at Larash there is no longer either Sultan or Pasha, and the houses have fallen into utter disrepair. At the top of the town is a curious old Moorish gateway covered with rude arabesques. Outside this gate the cattle market is held on a wide esplanade. Further south is an ancient fortress, built by the Portuguese at the beginning of the seventeenth century, and of curious construction. The river Lekkus, before reaching the sea, winds very much, forming several peninsulas. The first bend, almost parallel with the sea, is wide and deep, and serves as a natural harbour for boats and ships of small tonnage. A little dredging and enlarging of the river mouth would transform this natural shelter into an admirable port, from which might be exported the products of all the country, from the El-Ksar and Wazan regions, and even from Fez, which is only 200 kilometres (125 miles) distant. In the neighbourhood of Larash are found some Phœnician and Roman remains; here was probably the site of the Roman post *Lixus*, a name which has perhaps a connection with *Lekkus*. De Chenier in the eighteenth century, and others after him, maintained this idea, and asserted that the Arab name of the town, *El-Araish* (meaning "the bowers"), recalled the Garden of the Hesperides and the Palace of Anteus, while the river, with its many windings, had given rise to the legend of the famous dragon.

The population of Larash is about 10,000, of whom perhaps 2000 are Jews. The latter do not live in a special *mellah* or Ghetto. The Mussulmans are gentle and peaceable, as in all the coast towns open to foreign commerce. A few Europeans are established in Larash; the consular agents of the various Powers, the new French customs officer and two or three merchants or manufacturers—in all about ten persons.

An Italian has established a caravanserai on the high plateau overlooking the sea, from which point the road to Rabat starts.

The road to Tangiers by Arzila begins across sand-dunes, and to reach it man and beast are transported by ferry-boat. On summer mornings the blue calm waters of the estuary, the reddish sand with an occasional isolated palm-tree, the rude ferry-boats with their loads of men, camels, and mules, the caravans newly arrived, wading through the water to reach the shore, the Morocco fishing-boats with their copper-coloured sails anchored in the bay, the fierce sun illuminating all the scene with its burning rays—all give an impression of Palestine.

Larash to El-Ksar.

If sea voyages on the coast of Morocco are difficult and complicated, travelling by land is worse. One has to choose between walking and buying or hiring horses or mules, and it is only at Tangiers that one can get together a caravan without being too outrageously fleeced. Even there it is safer to procure a good guide or dragoman, and to leave all arrangements in his hands. In any case, the journey from Tangiers to Fez costs not less than from 1500 to 2000 francs (£60 to £80). If the railway is ever made, a return ticket, third-class, for the same journey will only cost twenty-five francs. Besides guide, cook, and muleteers, one must procure an escort of *one* soldier, whose presence is deemed necessary. Our escort proved a jovial fellow, whose stories enlivened our journey, but the mouth of his musket was choked up from dirt and want of use, and he himself seemed incapable of hurting a fly.

At each tiny timber bridge there is a tax enforced, legally or otherwise, and frequent bands of so-called "guardians of the roads" extort payment before allowing one to pass. Even the shepherds, emboldened by this evil example, arm themselves and make a further demand upon one's purse. A native merchant assured me that he was thus stopped thirteen times between Tangiers and El-Ksar, a distance of ninety kilometres. It is true that this is the worst part of the whole journey, and also that his assailants were content with the small sum of five sous (twenty-five centimes) at each stoppage. At each village where the caravan stops, a night guard is provided and receives high pay; eggs and fowls, the only food to be found, are enormously dear, and only to be had at all after much bargaining.

In winter the roads, always bad, become almost impassable from the flooding of the various rivers. This want of good roads naturally prevents any great commerce between Tangiers and the towns of the interior; there are only a few large merchants who make an annual journey to Fez on business. If there were established four or five caravanserai on the route, with shelter for man and beast, the journey might be much more rapidly and cheaply accomplished, without the impedimenta of tents, cooking utensils, baggage mules, etc. The erection of such inns, no matter how primitive, might be a profitable concern, and would precede by many years the construction of a railway or even decent roads.

After leaving Larash, we journey along the immense and fertile plain of the Lekkus river, where flocks of cattle, sheep, and horses are grazing, the property of the Sultan. Indeed in the Makhzen everything belongs nominally to the Sultan. On the track one meets numerous caravans of camels, asses, and mules coming from or going to El-Ksar, Wazan, Mequinez, and Fez. The great plain extends all the way to El-Ksar and might be made very productive. At present it is only used as pasture land. The river is navigable twenty kilometres from its mouth and in winter even to beyond El-Ksar, near which town we cross it by a ford.

El-Ksar (the great castle) is a small town of about 6000 inhabitants standing amidst flourishing orchards and gardens. But the town itself is in a miserable half-ruined condition, the ramparts half-destroyed, half-hidden by the accumulated rubbish of centuries, and the mosques and their minarets mostly in ruins. One of them, however, is picturesque with three fine palm-trees beside it. In spring-time great numbers of storks come to build their nests on the house-tops. They are never molested and are looked upon as sacred birds. Not far from the Jewish quarter of the town is a mill worked by steam, belonging to a Frenchman, who, with three or four other persons, constitutes the entire European population of El Ksar. Situated at the junction of the roads from Tangiers, Tetuan, Fez, Wazan, Mequinez, and Larash, and on the side of a large river, El Ksar might become an important commercial centre if the tranquillity of the country were more effectually secured and the means of communication improved.

From El Ksar to Fez.

If the villages of Morocco afford sufficient security as camping stations, they certainly do not offer much quiet or repose. At night incessant and varied noises drive afar any chance of sleep. An apparently infinite number of dogs bark all night long and howl in answer to the jackals in the fields. The village council gather round for conversation with our attendants. The night watchmen at first call to each other every ten minutes with gloomy voices, "Eh! watchman, pray God to keep you awake!" But happily God does not answer their prayers, and presently our guards are all sound asleep, which does not prevent them claiming their pay next morning.

Soon after leaving El-Ksar, one sees a large farm surrounded by orangeries, the property of the wealthy Sherîfs of Wazan. Then we cross bare stony hills where the track almost disappears. A few herds of cattle are still seen, a much finer breed than is seen in Algeria. On the backs or horns of these animals we saw perched many white ibises. We met also many caravans of camels and asses, too heavily laden often. All along the track were the skeletons of animals fallen *en route*, of which the dogs, jackals, and hyenas had made short work.

Some men of the Tafilalet joined us here on their return journey from Oran, where they had been employed as harvesters. On our left we perceived the ruins of a town, said by the natives to have been a

Portuguese settlement. Perhaps, however, it was only a Berber village; but it is curious to remark that the towers of the ramparts are round instead of square, as in the other Arab or Berber towns. At the right, small streamlets run down to low-lying gardens of fig-trees and pastèques (water-melons). This water comes from the "Aïn-el-Hut" (fountain of the fishes), a large tank with a half-ruined vaulted roof, evidently the remains of some important establishment. Here many of the large gold-fishes, which the Moroccans hold sacred, keep company with innumerable turtles. This fountain, as well as the neighbouring cactus-encircled village of Jerifi, is under the protection of the Sherîf of Wazan. The town of Wazan is about five hours' march to the east. Beyond this point the agricultural population becomes more numerous and the villages more frequent, some of them of considerable size and importance, others mere agglomerations of camels'-hair tents, which are moved from time to time as the pasture gets used up. The larger villages are composed of earth-huts grouped round two or three rude buildings, built of mud bricks, reddened and split by the heat of the sun. One of these serves as mosque and as council chamber for the Jemâa (village council) in wet weather. In winter wandering beggars are housed here also. The mosque is filthy in the extreme, and even the shortest visit to the interior is liable to be attended by unpleasant consequences in the way of vermin. The house of the Caid and a common store for the grain of the village (a source of constant dispute), are the only other buildings of any size. The Caid lives always in the most important village of the region of which he is the more or less accepted chief. The natives one meets are surly and impassive, hardly responding to a salutation even from one of our native escort. These are tribes who will not be easily accessible to European penetration, peaceful or otherwise. The Beni-Hassan, for example, live by pillaging the villages of flocks and crops. The Melaïna also, another powerful confederation of families emigrated from Miliana in Algeria at the time of the conquest of the latter province, remain independent of the Sultan, pay no taxes, and, in spite of the title of "French subjects" which they ironically give themselves, are more turbulent than the really native tribes. The principal products of this part of the country are barley, wheat and maize, cattle, sheep and goats.

The road continues across small hills and valleys, passing frequent villages with olive trees and vines. At one, we met a sort of travelling grocer and druggist with his wares in baskets on a donkey's back. At last we arrive in the great plain of the Wad Rebat, a deep, broad river of calm and limpid water. Except at the fords the river is so deep that horses lose their footing and are obliged to swim. The adjacent villagers make great use of the river in summer, bathing continually and watering their horses and mules, and the cattle love to stand in the deep water during the great heat. And yet the Rebat is only an insignificant tributary of the great Sebu river. On the side of the Rebat stands the village of the same name ablaze with the hot August sun. (One can count on a shade temperature of 104° Fahr. every afternoon during August and September.) Harvesters are winnowing the corn by throw-

ing it up in the air, when the wind blows away the chaff and the grain falls to the ground, while tam-tam players enliven their labour with music and song. After the harvest there are many feasts and marriages among the villages, and it is a good time for the travelling musicians. All night long the noise of flutes, clarionets, and tambourines trouble the rest of the weary traveller.

After crossing a small range of hills one descends into the fertile valley of the Wergha, the principal affluent of the Sebu river. On the banks of these two rivers are seen the only examples in Morocco of the practical canalisation of the river water; by a system of wooden wheels, moved by the current of the river, the water is raised to the level of canals which traverse the fields of melons and pastèques. The two rivers run almost parallel with each other for some distance before joining, only separated by a range of low hills. We descend upon the Sebu at a place called "Hajar Waket" (standing stone). This is an enormous conical rock, thirty metres in height, which stands up alone in the midst of the plain. Beside it is a small white-washed tomb, shaded by two palm-trees. At this part of its course, 150 kilometres from the sea, the Sebu is already as broad as the Seine at Paris, and in winter fording (difficult enough even in summer) becomes impossible. When the winter floods come down, the crossing is made on very primitive boats or rafts for passengers and goods; as for beasts of burden, they are simply thrown into the water, to swim across as best they may. With frequent difficulties of this kind, a winter journey to Fez may well take from twenty to twenty-five days.

From the Sebu the road trends towards the south-east, mounts and descends various hills, to reach at last the higher range, the first spurs of the Jebel Zarhun, behind which lies Mequinez. On the side of the range one sees the biggish village of the Beni Amar, built of stone and surrounded by olive woods. The inhabitants, as all through the Jebel Zarhun, are Berbers, independent of the Sultan, who allow neither European nor follower of the Sultan to enter their town. They are adherents of the Pretender, who was born here.

Further on one enters a narrow and dangerous defile, infested by highwaymen in the evenings, when caravans are few in number and they can act with impunity. The heat in this narrow valley is terrific, and the traveller rejoices in escaping from it into the little valley of the "Mikkes," which is crossed by a rude stone bridge, the first since Tangiers. The road now turns due east, and after crossing several more small valleys, arrives in a vast plateau, dominated on the north by the Jebel Trat. Here and there one sees pieces of enormous stone walls, the remains, according to the natives, of walls which formerly extended from the mountain to the river Fas, which one soon reaches, flowing clear and rapid between rushes and weeds. It winds down through the plain towards the town, before reaching which its waters are led into subterranean canals and closely guarded by the Sultan from the frequent depredations of the neighbouring hill tribes.

Fez appears in the distance encircled by its ancient and time-worn ramparts, behind which rise numerous white minarets, clearly outlined against the azure of the summer sky. It is Faz Jedid, with its palaces

and mosques, its silent streets in which no sound of carriage, no shriek of locomotive nor shrill whistle of factory is ever heard—the silence of an Eastern town. Beyond the walls to the west stretches the bare and yellow plain by which we have arrived, and from which the ramparts rise abruptly. The walls are full of little holes in which swallows build, who all day long circle and chase each other with their curious twittering cry. The appearance of Fez on arrival is that of a typical Moslem town which had fallen asleep in the Middle Ages and suddenly awakened at our approach. Behind the weak walls which protect the capital against the frequent attacks of the mountain tribes, rises the habitation of Mulai-Edris, the patron saint of the town and of Morocco.

Fez.

Fez, the present capital of Morocco, has not been touched by Aryan civilisation. Distant six days' march from the ocean, isolated by fanaticism even more than by the difficulty of access, it has remained apart from modern progress, with its 100,000 Mussulman and Jewish inhabitants, among whom live a mere handful of Europeans. For long years to come Fez will remain the type of a strange exotic town—of the ancient mediæval city of Islam.

To have a good view of the town, one must climb one or other of the heights to the north or south. Issuing by the gate "Bab-el-Gisa," one reaches the hill of the tombs of the Beni-Merin. To the north rises the Jebel Zalak (3000 feet), rocky, bare and grey, overlooking the town. At its feet runs the Wad Malah, which joins the Sebu four kilometres to the east. The Sebu is even here a large river, and in winter would be navigable for smaller craft all the way from the sea. West of the Jebel Zalak is another equally sharp point, the Jebel Kebkab, on the side of which camps the Berber tribe of the Lemta. Turning toward the town one has a splendid view of Fas-el-Bali (the ancient Fez), which lies at the bottom of a basin surrounded by gardens and slaty hillsides. To the east, outside the ramparts, appear country houses embedded in immense parks of shady trees, well watered by running streams. These running streams are one of the characteristics of Fez; they cross the town by a complicated system of canalisation, and then, yellow and dirty from the drainage they carry off, join to form the river Kherrareb.

Fas-el-Bali is divided into three great districts:—(1) *El Lemtiin* in the north, which was originally peopled by the confederation of the Lemta tribes: (2) *El Andalus*, in the centre, named after a numerous colony of Andalusian Jews who settled here under the Edrissites; the greater part of these Jews became Mohammedans, and many of the most ancient families of Fez bear names of Jewish origin: (3) *El-Adaua el-Karauia* to the south-east, which was the quarter of the people from Kairuan. These three great districts are subdivided into sections with no very distinct limits, but all presenting the same aspect of narrow winding streets or lanes, lined in most cases by two-storied houses. The houses are no longer whitewashed, which gives the whole town a

yellowish, coppery tint, contrasting with the whiteness of the mosques and minarets. The streets are paved badly or not at all, and are dirty and muddy even in summer. The different districts are closed at night by massive gates, and there is no lighting of the streets; consequently walking abroad at night is attended with difficulties. Each district has a *mokaddem* responsible for good order, morality, and cleanliness in his district! He is presumably overwhelmed by the vastness of his responsibility, and so does nothing at all! When the Minister of Finance has need of money he applies to the Pacha of the town, who in his turn applies to the various *mokaddems*, and they collect, each in his own quarter, a sum considerably above what is demanded, and naturally pocket the difference.

In the quarter of El Lemtiin are the fine house of the Caid MacLean, the Kasbahaud mosque of the Filali (people of the Tafilalet) and also the Medersa of Mulai-ben-Anan. [The Medersas are a sort of private hotel or club where students meet, sleep, and eat: but in which no teaching is done. The teaching indeed is all done in the mosques.] Here is also the fine mosque of the Sherabliin; Ain-el-Khil (fountain of the horses), where are the English and German Consulates, and the house of El-Menebbe, at present under seals.

The quarter of the Andalus also comprises several divisions, and is the commercial quarter of the town. Here, as in other Oriental towns, are the tiny dark shops, in which the native merchants sit surrounded by their goods and chattels and bargain vociferously with their customers. The "Kaiceria" is the most picturesque part, with its shops for embroidered garments, jewels, blue Moroccan ware, and other articles of value. It is in the Kaiceria also that is situated the sanctuary of Mulai-Edris, patron saint of Fez, and venerated throughout the whole of Morocco. It is forbidden to Europeans and Jews to approach the sacred tomb, or even to enter the surrounding streets. From outside the town, however, one can, with the help of a good glass, easily see all the details of the exterior of the mosque. The classic history of Morocco, the "Rudh-el-Kartas," gives a wonderful description of the glories and magnificence of this mosque, but to all appearance it seems quite of the ordinary type, fairly large and with a high minaret. In the centre is the tomb of the great saint covered with a square green-tiled roof. All the sacred buildings of Fez have pointed roofs instead of cupolas, and the tomb of Mulai-Edris in its pure whiteness standing out among the darker houses somewhat resembles a triumph of pastry-work powdered with white sugar. The interior is said to be finely decorated with the characteristic Fez plaster-work and coloured mosaic.

In this neighbourhood is the famous mosque of Karauïn, celebrated as the great intellectual and educational centre of Morocco: here the best professors give their lectures, and a valuable library is hidden from the eyes of the outside world, no European being admitted into any holy place in Fez—not even into the smallest ruined tomb. For long years the Moslem world has reckoned Fez, and more particularly the Karauïn mosque, as the abode of all learning and science.

In all Islamic countries the name Fas still evokes the idea of a celebrated university; of a source of intellectual progress and knowledge. In reality this reputation is greatly exaggerated, at least according to European standards. The students are made to store their memories with an enormous quantity of knowledge by rote; they learn by heart the Koran, whole treatises on grammar and theology, Sidi-Khelil on law, a little history and arithmetic. This method produces young "savants" who know in advance and by heart the answer to such and such question always asked in the same form.

The suburban villas and gardens begin in the Andalus district; here are most of the private residences of the ministers, and also the French consulate.

Two gates, the Bab-el-Hedid (iron gate) and the Bab-el-Jedid (new gate) lead from this aristocratic quarter into the open country.

El-Adaua district lies to the east, and contains a mosque of the same name, almost as much revered as that of Mulai-Edris, and also a sort of commemorative chapel, where the Faithful pray to the great saint at certain fêtes. Near here is the bridge, Beïn-el-Medux (*i.e.* between the two towns). All this quarter of El-Adaua offers nothing very interesting, being entirely a mass of silent and gloomy dwelling-houses, separated by winding lanes, so narrow that two horsemen cannot pass each other. Only quite poor folk go afoot in Fez.

The population of Fas-el-Bali, especially in the commercial quarters, is very heterogeneous. Merchants, porters, mule and donkey keepers, buyers from the tribes of the interior, Berbers from the mountains and Arabs of the plain, negro Buakhers, and ragged soldiers, all hustle and elbow each other incessantly in the narrow streets.

There are two real post-offices at Fas-el-Bali, the French and the German posts, who send regular foot-runners with letters to El-Ksar three times a week. From that point the mails are taken on by other runners.

Fas-el-Bali according to tradition and to history was founded by Mulai-Edris, the son of Mulai-Edris the Hosseimite, father of the dynasty and first iman (high priest) of the tribes of Onarabe. The town was founded in the year 192 of the Hegira (808 A.D.), and many improbable and ridiculous legends have been handed down about it. It is said that Mahomet had predicted the creation of the town, that, in the beginning, the river Fas rolled down pearls in its course; that salt-springs in the neighbourhood produced wonderful salt of various colours, etc. etc. The chronicles relate that it was under the Almohades in the twelfth century that Fez attained its greatest splendour. Since then it has gradually decreased in importance, although still holding a respectable place among Moslem cities. If, by an organised administration, a modicum of cleanliness and sanitation were introduced into the town, modern civilisation, by gradually utilising its numerous rivers and its position between Algeria, the Mediterranean, and the Atlantic, would give a new impulse to its commerce and industries, and the ancient Fez might once more become one of the first cities of the world.

The north bastion of the town is an enormous square fortress, of

architecture similar to that of Larash, and probably built by Christian slaves. Beyond this is the Suk-el-Khemis (Thursday market), an immense esplanade where the cattle market is held. Further on still, and quite outside the town, but touching it at one corner, is the Kasba of Sherarda. This is a huge platform, 300 metres square, enclosed by crenelated walls; its original purpose does not seem very clear, but at one time it served as barracks for the recruits furnished to the Sultan by neighbouring tribes. Near here is the largest Mussulman cemetery, overlooking a narrow valley, laid out in shady gardens, within the ramparts. This valley is the Bu-Jelud, and forms a sort of suburb between the two cities, Fas-el-Bali and Fas-el-Jedid, the old and the new Fez. The Bu-Jelud gardens, with the Fas river flowing through them, are a favourite resort of the ladies of the harem of the Sultan, to whom the valley belongs.

Fas-el-Jedid, or the New Fez, was built in the thirteenth century by the Merinides, a Berber dynasty at that time in power, to keep in subjection the old Fez (Fas-el-Bali). Here they made their palaces and barracks, and it has remained ever since the official town, looking down from its superior height on its older and less cared-for neighbour. It is this newer and higher Fez which one sees on first arriving across the plain by the Tangiers road. An arched gateway, ornamented with fine coloured mosaics, leads into the new Meshuar, a large paved space within four walls, where the Sultan receives Europeans who demand audience of him. Of recent years, however, it has been little used, as the Sultan makes a rule now of receiving only official personages. From the Meshuar one enters by a very ordinary European entrance into the arsenal, where arms of various kinds are made—or rather repaired, for most of the war material is bought direct from European factories. To the south of the arsenal is the mosque of Mulai-Abd-Allah and the Mehakma or Court of Justice. A crowd of people sit in the shade, plaintiffs and defendants, waiting their turn to appear before the great Cadi. Presently one comes to the Dar-el-Makhzan (Palace of the Government), a confused mass of buildings of different ages, joined together by covered corridors. One part is reserved for the Pacha and his *mekhazni* (guards); here Moroccans of all ranks are constantly coming and going in the vestibules, talking, disputing, and quarrelling noisily. In a great paved court, surrounded by arches, the ministers meet every morning to discuss affairs of state, and of their respective departments. Each of them is installed in a recess (*benika*) surrounded by his secretaries. A sort of Court of Appeal from the Pacha's court is also held here by the ministers. Each minister also dictates the letters of the day to his secretaries—beautiful letters, full of flattering and amiable phrases and promises intended to instil the virtue of patience into the minds of those who are waiting for a settlement of some business affairs. There is no clear division of labour among the ministers, and they all rank alike. Below them in grade are the *amin*, with no definite functions. An *amin* may be called upon to act as vice-minister, or to undertake the duties of a rural constable. The archives are kept in the most primitive manner; letters received, copies of letters sent out,

all sorts of correspondence are thrown pell-mell into large boxes. One may imagine the difficulty of finding any particular paper required! But God is master of time, and one may add that Moroccan officials are past masters in idleness. This lazy indifference is one great reason why Morocco has retrograded rather than advanced during several centuries.

Behind the Dar-el-Makhzan is the palace of the Sultan, entrance to which is forbidden, on account of the great number of women who live there. It is said that there are nearly three thousand, including servants and negresses.

Behind the palace, to the south-west, begins a series of magnificent gardens, with poplars, cypresses, olive and fruit trees of various kinds, and beds of bright-coloured flowers, irrigated by canals of swift, clear water. These canals are supplied by an aqueduct and two hydraulic machines. The ancient gardens of Lalla-Mina and Agdal are within the walls, and from them a private gate leads into the newer gardens, beyond the ramparts, over two kilometres in extent, which one is allowed to visit. Quite near here a small private railway runs from the palace, along by the new gardens and the aqueduct, to Dar-Debiber, a country-house of the Sultan, about four kilometres off. Unfortunately, this railway, constructed much against the prejudices of the Fez people, has never been used, because the locomotive arrived without its wheels, and their whereabouts cannot be discovered!

To the east of the garden of Lalla-Mina is the Mellah or Jewish quarter, enclosed by high walls and massive gates. At Fez the old order prevails, and it is strictly forbidden for Jews to live outside their Ghetto, which was purposely made in Fas-el-Jedid, rather than in the older town, in order that the Jews might be under the direct protection of the Sultan, against the intolerant and rebellious people of Fas-el-Bali. It has always been the policy of the Sultans to protect the Jews, who make themselves useful commercially, and as intermediaries with the coast. At Fez, as in the other towns of the interior, the Jews differ equally from the Spanish Jews of the coast, and from the fanatic and debased Israelites scattered among the Berber tribes of the mountains. They are industrious, gentle and resigned. They become, therefore, less and less subjected to the ancient severe laws which forced them to take off their shoes before a mosque, to walk humbly against the wall, to bow down before a Moroccan dignitary, and to keep silent before all Mohammedans. All the men wear the gaberdine and black cap, the older ones still keeping to the ancient headgear, a blue checked kerchief tied under the chin, like lower-class Spanish women. Among them there are some very fine types. The men of the young generation, who frequent the school of the Israelite Union, all speak French, and are dressed cleanly and decently. The Mellah, however, is as dirty and ill-kept as the rest of the town. The streets are strewn with rubbish and dirt, and swarm with flies and vermin. In the grocers' and druggists' shops of the tiny, winding streets one sometimes finds European goods which it is hopeless to look for in the Arab markets. One can easily get access to a Jewish interior, some of which are very

luxurious, the walls decorated with highly varnished tiles of many colours. There is generally a small court or "patio," round which runs the gallery with the household rooms. The women are not kept secluded like the Arab women; they live amicably, four or five together, with many servants in well-to-do houses—for the Jews of Fez practise polygamy. The costume of the women consists of a coloured skirt, drawn in at the waist, a short, open bodice over a muslin chemisette, and on their heads a head-dress *à la russe*, a sort of diadem of black or red silk, which is very graceful. All these women are good-looking, and gay, and talk agreeably.

The Environs of Fez.

There are some interesting excursions to be made round Fez, and this can safely be undertaken if one returns to the town by sunset. After that hour, the Mussulman citizens and, still more, the Christians run the risk of an unpleasant encounter and a shot or stab from one of the Berbers of the neighbourhood, always on the look-out for a chance of robbery, in which the absolute non-existence of an effective police encourages them.

Leaving Fas-el-Jedid by the Bab Segma, and climbing an olive- and fig-tree covered hill, one has a very fine general view of the official town. On the way one passes the Marabout of Sidi-Amara and the *Mesalla*, or oratory of the Sultan, a sort of oblong court, surrounded by dazzling white walls, where the Faithful resort for public prayers on the great festivals.

Not far from here is a camp of soldiers, whose white tents are arranged in a circle round one of much larger size, with a design in black on its white sides—the tent of the chief Caid. As at Tangiers and all the other garrison towns, the greatest freedom is allowed to the soldiers, who wear or not their uniforms as they please; deserting and the selling of arms and habiliments remain unpunished; the most elementary discipline is practically unknown except when the soldiers are summoned to escort the Sultan from his palace to the mosque. The poor and irregular pay obliges the men to work at various trades in the town to support themselves.

Walking round the ramparts, one crosses the river Fas by the bridge called Kautra-Kebira, and presently comes upon the new gardens and to the Dar-Debiber, the country villa of the Sultan, a group of miscellaneous buildings hidden behind poplars and fruit-trees of all kinds. Thence, crossing the Aamir stream, one reaches the track leading to Sefron, a little, independent Berber town, subject to the Beni Metir, who inhabit the land between this and Mequinez, and are always in arms against the Sultan.

Following the crest of the rounded hills immediately to the south of the town, one has splendid views of Bu-Jelud and Fas-el-Bali. On the side of these hillocks camps another *meh'alla* (regiment of soldiers) more important than the other mentioned before. Passing by the southern bastion, one enters the town again by the Bab-el-Fetuh.

Or, instead, one may continue further south to the hills where the Sherarda tribes dwell, and to the valley of the Ulad-el-Haj, in which the meandering Sebu river runs. The river is already large here, and might be navigable in winter. By an old stone bridge the road to Taza crosses it—"Taza the accursèd"—where the presence of the Pretender still disquiets the government, which has not forgotten the evil days of panic when Fez itself narrowly escaped falling into the hands of the followers of Ban Hamara. Beyond the Sebu lie regions dangerous to travel in, where the Sultan has scarcely any authority—indeed his authority is little recognised beyond the tracks followed by the caravans, and the capitals and towns of the west coast. So much is this the case that, when the court moves from Fez to Merrakesh, instead of following the direct way which crosses the independent regions of Zemmur and Tadla, it has always travelled to Rabat, a port on the Atlantic, followed the coast for 150 kilometres to Mazagan, and thence returned inland to Merrakesh through subject tribes.

To the south of Fas-el-Jedid, between the ramparts and the hills, lies a desolate, uncultivated region, the general "dumping ground" for unmentionable and pestilential débris. Near here are several brick-works, where the natives make rude bricks from grey clay and dry them in the sun. Further east the various branches of the Zitun river irrigate many market gardens, whose rich and fertile soil produces several crops a year. At present, in this month of September, nearly all the ground is covered with an excellent crop of hemp. In the bottom of the Bu-Jelud valley an immense reservoir, from which numerous canals lead water into the neighbouring fields, serves as a public washing-place. Here the poorer natives, sun-burnt and half-naked, tramp their linen on the broad edges of the basin.

Life in Fez cannot be called gay, and the town oppresses Europeans by the gloom of its intolerant and fanatical past and the wearisome routine which has enveloped it for centuries. It is, indeed, for the Christian, that "Medinat-el-Kent" (the town of Despair) of which the Faithful speak.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

At a meeting of Council on Jan. 9th, a letter was read from the Senatus of the University proposing that the Society should use its influence in endeavouring to institute a Lectureship in Geography in the University. The Council expressed gratification at the proposal of the University Court, and the result of the discussion on the matter is as follows:—

The Council is prepared to give its hearty support to this project, and will gladly co-operate with the University in the prosecution of such measures as may be deemed desirable.

While unable to give any definite assurance regarding the prospects

of raising funds, the Council is inclined to think that the proposal would meet with a more enthusiastic response if a Chair of Geography was the object in view—a Lectureship being alternative if the funds were insufficient to endow a Chair. They also think that in making any public appeal, it would be of great consequence that some assurance should be given by the University authorities that the Chair or Lectureship, if founded, shall receive proper academic standing: and in particular that the subject of Geography shall be placed in the scheme for graduation in Arts and Science.

The Council is also of opinion that there should be no delay in taking action, and begs to suggest the formation of a small executive committee, composed of one representative from the University Court, two from the Senatus, two from the Geographical Society, one from the Royal Society of Edinburgh, and one from the Edinburgh Merchant Company. If this suggestion is approved, the Council would nominate Professor Geikie, the President, and Mr. J. G. Bartholomew, Hon. Secretary, as their representatives on such a committee.

Lectures.

On the 3rd January, in the Athenæum Hall, Glasgow, Mr. Arthur Hill delivered a lecture on Lake Titicaca, Mr. W. F. G. Anderson presiding. Mr. Hill repeated his address on the 4th, in Edinburgh, Dr. James Burgess, C.I.E., taking the Chair.

At Dundee on the 6th January, and at Aberdeen on the 7th January, Dr. J. H. Wigner delivered an address on his travels over the "Great Snowfield of Iceland," Mr. I. J. Weinberg and Professor J. Arthur Thomson respectively occupying the Chair.

Mr. S. L. Bensusan lectured on "Morocco" at Edinburgh and the other centres. On 25th January he addressed the members in Edinburgh. On the following day he repeated his address before our Glasgow Centre. The Dundee Branch met to hear Mr. S. L. Bensusan on the 27th, Mr. I. Julius Weinberg presiding. Lastly, on the 28th, the lecture was repeated before the Aberdeen Centre, Mr. William Smith, Advocate, taking the Chair.

GEOGRAPHICAL NOTES

Europe.

The Province of North Brabant.—An interesting account of the distribution of human settlements in this province, based upon Dutch investigations, appears in a recent number of *La Géographie*. The Province is geographically well-defined, and consists of a vast plain, slightly dipping towards the north, formed of Quaternary deposits, which are still being added to along the Meuse. In passing from the south to the north we encounter three towns whose fate has been virtually

the same: these are Bergen-op-Zoom, Steenbergen, Zevenbergen. All three were formerly very prosperous, owing their importance to their situation and their commerce, which was principally carried on with England. But the growth of the alluvial deposits in the bed of the Escaut, combined with other causes, has led to a gradual diminution of their importance, and has caused their trade to sink to merely local significance. During the nineteenth century, however, all this western part of Brabant re-acquired some industrial importance owing to the cultivation of the sugar-beet. Of the thirty-two sugar manufactories of Holland, twenty-one are situated in this region. Further to the east is placed the town of Geertruidenberg, situated on the edge of the Biesboch, which was rich in fish during the seventeenth and eighteenth centuries, and afforded the town an important source of revenue. But here again a continued deposition of silt and mud took place, and this has spoilt the fishing, so that the town now chiefly depends upon its trade in reeds and rushes. There are also a series of towns placed on the banks of the Meuse, such as Heusden, Megen, Ravestein, and Grave, none of which have attained any great importance on account of the difficulties of navigation in the river, and the high tolls.

The settlements of the interior of the Province are nearly all placed upon the affluents of the Meuse, which in this flat region are frequently navigable, and constitute the natural ways of communication. The confluents of the tributaries naturally become centres of concentration for the population, and centres of trade. Examples are Bois-la-Duc at the confluence of the Aa and the Dommel, Breda at the confluence of the Mark and the Aa. An interesting peculiarity in regard to the distribution of the population is the great abundance of minor centres. There are in all 184 communes, each including small villages and hamlets—a number without a parallel in any other province. The soil has been taken possession of first in the vicinity of the rivers, thence cultivation has progressed towards the interior. A curious fact, apparently due to the racial history of the inhabitants and the strength of the family tie, is the breaking up of the land into innumerable very small holdings. In consequence the peasants have always been poor, and as the cultivation of the tiny farms was not sufficient to take the whole time of their possessors, minor industries are frequent and long-established. Spinning and weaving especially were early common as cottage industries. Gradually, much as has occurred in parts of Scotland, a tendency has developed for the factory to replace the scattered industries of the home, and the villages have thus been swamped in new industrial centres. Thus, for example, Tilburg, which is now the principal centre for the manufacture of wool, had 3000 inhabitants in the fifteenth century. At the end of the eighteenth century it had 8500, and in 1900 the population had increased to 40,600. Quite similar has been the history of Eindhoven and Helmond. To the east of Geertruidenberg extends the region of Langstraat, where, under quite similar conditions, the industries of tanning and shoemaking have developed.

Asia.

The Exploration of the Caspian Sea.—M. Knipowitsch gives in *Petermann's Mitteilungen* (xii. p. 291) some further notes on his recent expedition to the Caspian (cf. this *Magazine*, xx. p. 490). In his previous communication the author stated that the inferior limit of life, except for micro-organisms, was 400 metres, at which depth no living animal was found. Subsequently, however, a living Oligochaete worm was found at this depth in about 40° 3′ lat. and 51° 6′ long. on the bottom. Where the depth of water exceeds 400 metres it would seem that this figure represents about the limit of the downward extension of the plankton, though it is possible that the inferior limit varies according to the season of the year. As regards the diminution of the amount of oxygen with depth, further investigation has shown that this is not uniform in the two deep regions of the lake, that is, its middle and southern portions. In the middle region the amount of the gas diminishes with depth much more rapidly than in the southern part. The currents of the lake were carefully investigated, the result being to show that the most prominent are a southerly current along the west coast, and a northerly along the east. As a consequence of these currents the temperature of the water is higher on the east coast than on the west. There is, however, great seasonal variation in the temperature of the water, this being true both of the upper and of the lower layers. The lowest temperature obtained was 1·8° on the bottom in shallow water near Buinak, and the highest 21·6° at the surface. A large amount of information was also obtained relative to the Caspian herring, the investigation of which was one of the main objects of the expedition.

Climate of Shanghai.—In *Nature* for December 29 there appears a note on the climate of Shanghai, based upon observations made by the Rev. J. de Moidrey during the years 1873-1902. The coldest weather occurs about the beginning of February, and the warmest about August 1, nearly forty days after the solstices. The mean temperature for thirty years at the Zi-ka-wei Observatory was 59·2° F., and the mean range 43·2°. The extreme readings were—maximum 102·9°, minimum 10·2°. The average monthly relative humidity is 78 per cent.; the annual variation is insignificant, averaging only 4 per cent. The average yearly rainfall is 43·6 inches. June is pre-eminently the rainy month, both for frequency and amount, while December is the driest month.

Africa.

Gordon Memorial College at Khartoum.—In this *Magazine*, vol. xviii. p. 650, we recorded the appointment of Dr. Andrew Balfour as Director of the Wellcome Research Laboratories at Khartoum. We have now to welcome the first-fruits of Dr. Balfour's work in the shape of the First Report of the Laboratories (Khartoum, 1904), which recently reached us. The Report contains an illustrated account of the Laboratories, together with papers on the various subjects which have

engaged the attention of the staff since the opening of the buildings. The most generally interesting of these papers is one on mosquito work in Khartoum and the Sudan generally. Dr. Balfour's observations have shown that the statement that mosquitoes are rare in Khartoum is not founded on fact, for malaria-carrying species do occur in the town, as well as species capable of carrying other diseases. A mosquito brigade has been organised with good results, and among the minor benefits of its labours has been the location of every well in Khartoum, a fact of great importance in the event of any extensive outbreak of enteric or cholera. Further, a considerable number of observations have been made on the distribution of the Culicidae in the Sudan generally, and a map has been prepared to show the results of these observations. As a preventive measure at stations in the swamp regions of the White Nile, Dr. Balfour recommends the cultivation of sunflower, which has been successfully cultivated in the previously malarial stretches of the Mississippi valley, and is known to grow well in the Sudan. A minor point of some interest in the Report is the proof that steamers are of considerable importance in the distribution of mosquitoes.

Lieutenant Boyd Alexander's Expedition.—Those who have followed the course of Lieut. Boyd Alexander's expedition to Northern Nigeria, as detailed in these pages, will learn with regret that Captain Claud Alexander, who accompanied his brother's expedition as surveyor and map-maker, died of enteric fever on November 30. Captain Claud Alexander, who was only twenty-six at the time of his death, had studied surveying under the instructor of the Royal Geographical Society, and had been granted the loan of instruments by that Society for the purpose of the expedition. It is not known to what extent his premature death will alter the plans of the expedition.

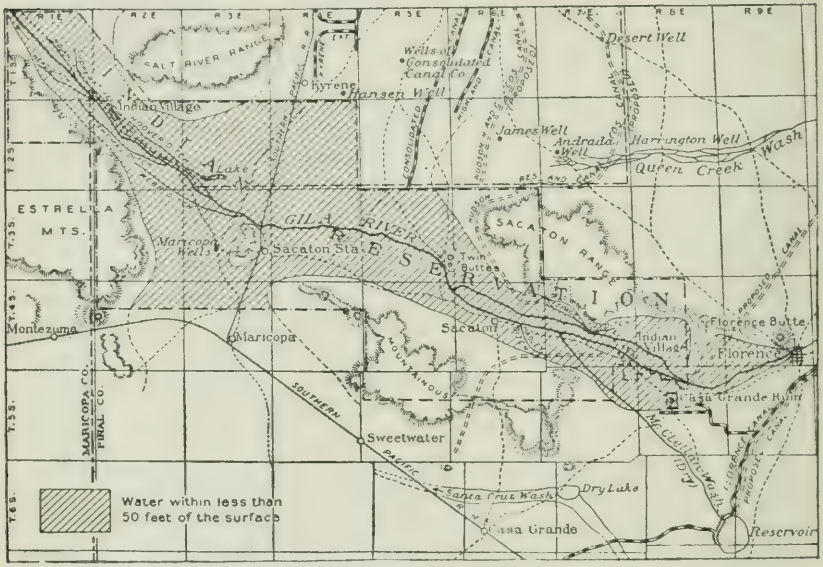
The latest news of the expedition is contained in letters written before the death of Captain Claud Alexander, but only recently received in this country. According to these letters, Captain Claud Alexander towards the end of October was approaching Kuka, on the western shore of Lake Chad, from the direction of Maiduguri, after a very arduous journey, the latter part of which was through very dense bush-country. The difficulties which the expedition had encountered from the moment of its arrival on the Middle Benue, where a permanent camp was established at the village of Ibi, had been greatly intensified by the famine from which the whole of the eastern part of the Protectorate was suffering. Captain Claud Alexander had travelled from Ibi to Bauchi, and from Bauchi in a north-easterly direction to the upper waters of the Gongola River, and had then followed that stream down to Ashaka (or Astaka), in 10° 26′ N., 11° 7′ E., where it had been determined to establish the second permanent camp (*cf.* this *Magazine*, xx. p. 603). He arrived at Ashaka about the middle of August, two days after the arrival of the boat flotilla, which had taken six weeks to make the journey from Ibi by river. Ashaka had been selected as the site of the second permanent camp because it was the centre of a number of populous villages, from which it was hoped that the expedition would be able to

draw sufficient supplies to enable a long stay to be made there. But this district was found to be equally in the grip of famine, and it proved necessary to abandon the plan for a triangulation of this district, and to push forward at once to Lake Chad. Captain Claud Alexander and Captain Talbot set out by different routes for Kuka, but succeeded in effecting a junction some three days' journey to the north-east of Maiduguri. Meanwhile the other section of the expedition carried the boats in sections from the Gongola to the Komadugu river. The ascent of the Gongola had been rendered extremely difficult by the occurrence of several rapids, through which the boats had to be hauled from the banks. A start was made with the sections of the boats from Ashaka at the end of August, the route followed being by way of Gujba to a place called Geidam, within a mile of the Komadugu River. Geidam is stated to be an important caravan centre on the trade route between Kano and Kuka. Close to this place the steel boats were put together again, and Captain Gosling began the descent of the hitherto unexplored Komadugu River to Lake Chad. Jose Lopez, the Portuguese zoological collector attached to the expedition, followed the road, which touches the river at several points, and succeeded in obtaining many interesting specimens to add to the zoological collection. The Komadugu proved to be a sluggish stream, flowing over a sandy bed in low, flat banks, clothed here and there with thorny acacia. Its course was tortuous, and the only obstructions to navigation were snags, through which at certain points the boats had to be forced. The average width of the river was about forty yards, and the current never exceeded two and a half miles an hour. The period of high water is from August to the middle of December, and then the depth is about six or seven feet; but at other times the bed is mostly dry, with occasional pools. It is this river which, for some considerable distance, now forms the frontier between the British and French spheres of influence to the west of Lake Chad. Yo, a place of some local importance situated at no great distance from the Lake, was reached on the 3rd October last, and from that point the boats entered the Lake, where their behaviour proved to be entirely satisfactory. The rest of the month appears to have been spent in the neighbourhood of Yo, and on the last day of October Lieutenant Boyd Alexander was to start for Kuka, where he hoped to meet his brother and Captain Talbot. On his way south Lieutenant Boyd Alexander hoped to discover a place on the Lake shore which the boats could use as their headquarters in continuing their exploration of Lake Chad. The telegram which conveyed the news of Captain Claud Alexander's death did not state the place at which it occurred.

America.

The Gila Valley, Arizona.—Mr. Willis T. Lee has written a paper on the underground waters of this valley for the U.S.A. Geological Survey (*Water Supply and Irrigation Paper*, No. 104), which, though primarily economic, contains an exceedingly interesting account of the physical geography of the region. The accompanying map will make

clear the main facts in regard to the topography of the district. The Gila Valley may be defined as the region lying between a point fifteen miles to the north of the town of Florence, known as The Buttes, and the point of junction of the Gila and Salt Rivers. The greater part of this area forms the Pima Indian Reservation, and is shown in the map. At The Buttes the Gila River leaves the mountains to enter upon the plains. Below this point the river loses in volume until its junction with the Salt River, and throughout the greater part of the valley the river bed, save in floodtime, is dry, the water sinking below the surface. At two points in the valley, however, the waters return. One of these is situated at a point about ten miles east of Sacaton, and east of the

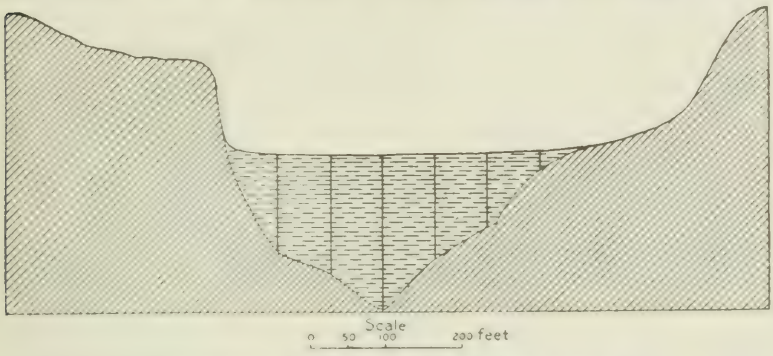


Map of Pima Indian Reservation.

point where, as the map shows, the mountains encroach upon and narrow the valley. Here the underground water returns to the surface in the river bed, and forms a stream of several hundred inches. This stream continues on the surface for a few miles, and then either disappears in the sands of the river bed or is diverted for irrigation purposes. The second return is one of great interest. It occurs near the point where, as indicated on the map, the Southern Pacific Railroad crosses the river (Gila Crossing). About five miles west of the railroad, and a little north of the Gila channel, there lies a permanent body of water known as the "Lake." The lake is surrounded by marshy ground, but the body of water is itself about 4000 feet long. The water is about 6 feet deep, and there is a great depth of soft mud at the bottom. This area of water drains continuously through the swampy slough which connects it with the river channel. That it is a true return to the surface of under-

ground water is proved by several considerations. The rainfall of the region is only about 7 inches per annum, and the annual evaporation about 91 inches, so that its origin from atmospheric precipitation is at once excluded. For a distance of about fifty miles above the lake the Gila River is dry except at flood-time, and these floods when they reach Gila Crossing are rarely of a volume to directly affect the amount of water in the lake. Further, in the sloughs in the vicinity of the lake copious springs have been observed.

Such are the main facts in regard to the hydrography of the Valley. The explanation of them is very interesting. The valley has a length of about seventy-five miles, and a width of five to ten miles, and is partially defined by mountain ranges, but at three regions merges into the general plain which forms the desert surface of South-western Arizona:— (1) It connects with the Salt River Valley between Salt River Range and Sacaton Range on the north; (2) it opens into the general plain to



Cross Section of Gila Valley at The Buttes, Arizona.

the south in the vicinity of Maricopa; (3) much further to the east it opens to the Casa Grande Valley. The mountain ranges which close in the valley except at these three regions are shown in the map. Apart from those already named, the most important is the Estrella Range. In all cases the hills are remarkable in that they rise abruptly from the valley floor, so that the plain region is sharply separated from the mountain, without any grading between the two. The mountains are of crystalline structure. These peculiarities of structure are not confined to the Gila Valley, but occur in the surrounding regions, and suggest that the whole of this part of Arizona was once a deeply dissected granitic plateau. Owing to earth-movements the streams which had been wearing down the valley floors changed the form of their activity, and began to fill up the valleys which they had previously excavated. In other words, they "changed from degrading to aggrading streams." The result was to fill up the older valleys with a great accumulation of loose deposits of silt, sand, gravel, and so forth. From the surface of these filled-in valleys the mountain peaks now rise abruptly, owing to the covering of their bases by the deposits. The depth of the deposits in

the Gila Valley is not known except at The Buttes, where only boring has been carried out. Here twenty-five holes were drilled in search of a firm foundation for a dam, and bed rock was found at a maximum depth of 122·5 feet, the boring showing that the original valley had a canyon form (see Fig.). The material which fills the valley is quite loose and unconsolidated, and the water in consequence sinks down through it, instead of flowing upon the surface; hence the whole region acquires desert characters. The figure shows the ancient valley now filled with river drift.

As to the cause of the rise to the surface of the water at the spot named above to the east of Sacaton, it is generally believed in the region that there is something of the nature of a natural dam at this point, which forces the water to the surface, but Mr. Lee finds that the geological evidence is all against this supposition. His explanation is that the rise of the water to the surface is due to the narrowing of the valley at this point by the inward projection of the mountains, which forces the water to rise just as in an ordinary stream a similar narrowing involves a rise of the water-surface. The explanation of the occurrence of the "Lake" at the Gila Crossing is more complicated. In the southern region of the map there appears a part of the dry bed of the Santa Cruz River, which sinks into the sand long before it reaches the area under consideration. Various considerations suggest, however, that at one time the Santa Cruz joined the Gila in the vicinity of Maricopa, and it is probable that in this region the underflow of the river joins the Gila underflow. Again, there is much evidence to show that the underground waters of the Salt River enter the Gila Valley in the gap between the Sacaton and Salt River Ranges and join the Gila in the vicinity of Gila Crossing. The appearance of a considerable body of water at the surface at this point is therefore probably due to the junction of the three underflows—those of the Gila, Salt River, and Santa Cruz. In a very rough way we may therefore say that at present in the Gila Valley region the waters still flow in their old valleys, in spite of the fact that these valleys have been filled up by deposits of more recent age.

Glaciation in North America.—Mr. R. D. Salisbury has recently published a *Report on the Glacial Geology of New Jersey* (see also *Nature*, December 22) which contains some interesting comparisons between recent and Pleistocene glaciers. He points out that the whole drift-covered country in North America is only ten times as large as that still covered by the ice cap in Greenland. The Antarctic ice-sheet, again, is as extensive as that which is believed to have covered North America during the Glacial Period. This fact, according to the author, "removes the element of incredibility which at first thought attaches to so striking a theory as that of the glacial origin of the drift." As to the cause of the extension of the ice sheet of Pleistocene times into temperate latitudes, Mr. Salisbury adheres to Chamberlin's hypothesis of the effect of variations in the amount of carbon dioxide in the atmosphere. Elevation of the surface of the land accelerates rock-decay, and this promotes

refrigeration by withdrawing carbon dioxide from the atmosphere. Another cause which affects the amount of this gas in the air is the activity of volcanoes.

Polar.

Proposed Biological Station in Greenland.—A scheme is on foot for the establishment in Greenland of a permanent station for the study of the many interesting problems presented by that ice-clad country, for there is a general feeling among scientists that, admirable as is the work which has been done by many explorers, the limited time and opportunities available during an expedition leaves many problems untouched. The leading spirit in the present movement is Morten P. Porsild, a Danish botanist, who has succeeded in interesting various scientific bodies in Denmark, and proposes to establish a station in Godhavn, on Disko Island. It is believed that such a station could be built at an outlay of 35,000 kroner, and maintained at a yearly cost of 11,000 kroner. The problems in which Mr. Porsild is specially interested are naturally botanical. He desires, in the first instance, to found a botanical garden where the effect of light and of the low temperature on the nutrition of plants could be studied, together with the question of their means of distribution over glaciated regions, but there are of course a very large number of other problems which could be studied at the same station. Apart from pure science, it is proposed also to devote time to economic questions, such as the fisheries, the possibility of forming pastures of the indigenous grasses for feeding horses and cattle, of keeping herds of tame reindeer, and domesticating the valuable blue fox, and so on.—*Petermann's Mitteilungen.*

The "Discovery" Antarctic Expedition. — This interesting collection was exhibited in Edinburgh from January 9-14. It consists of over five hundred items, and is composed largely of water-colour drawings and pencil sketches by Dr. E. A. Wilson, photographs by Lieut. Skelton, and a number of articles used by the members of the expedition. The pictures and photographs are of much interest and scientific value, and include many representations of the bird fauna of the Antarctic, especially of the penguins, water-colour sketches of the striking solar phenomena observed, as well as many views of the scenery and topography of the Far South. The exhibits also included a model of the *Discovery*, and various parts of the equipment used on the great sledge journeys carried out by the members of the expedition.

General.

The British Association Meeting in 1905.—Some details are now available in regard to the arrangements for the visit of the British Association to South Africa during the present year. A Central Executive Committee has been appointed in South Africa, under the chairmanship of Sir David Gill, H.M. Astronomer at the Cape of Good Hope. The pro-

visional programme for the meeting is as follows:—The members of the Association will leave Southampton on July 29, and land at Cape Town on Tuesday, August 15, and the Presidential Address will be delivered the same evening, the rest of the week being devoted to meetings in the mornings as usual, and lectures, social functions and excursions in the afternoons and evenings. Saturday will be devoted entirely to excursions, and in the evening of the same day a special steamer will leave direct for Durban. About two days each will be devoted to Durban and Maritzburg, and another couple of days to the Natal battlefields, so that the visitors will reach Johannesburg on Monday, the 28th August, and have the rest of that week on the Rand and in Pretoria, going thence *viâ* Bloemfontein to Kimberley, and after spending two days at each of these towns, proceed to Bulawayo, and finally to the Victoria Falls. If a minimum of one hundred members decide in sufficient time to return to England *viâ* Beira from Rhodesia, the Union-Castle Steamship Co. will provide a special steamer sailing by the East Coast and Suez Canal. The rest of the party will return to Cape Town on Tuesday, September 19, and leave for England on September 20, arriving at Southampton on October 7th, which involves a total absence from England of seventy days.

The Geographical Association.—The Annual Meeting of the Geographical Association took place in London on January 6, the President, Mr. Douglas Freshfield, occupying the Chair. In his presidential address, Mr. Freshfield alluded to the recent controversy in the *Times* on the teaching of geography. A discussion on Practical Geography in Schools was then opened by Professor Dryer, of the State Normal College, Terre Haute, Indiana. Professor Dryer said that the term "practical geography in schools" meant in America laboratory work. It was not necessarily done in a special room, and, indeed, the best part of it was done out of doors. But it was the work which was done with things, and not with words, written or spoken. The study of maps played a large part in this laboratory work. To physical geography a great deal of attention had been devoted in America, and the study of this subject was largely pursued on the land. Contoured topographical maps were also much used, together with raised models illustrating different forms of the earth's surface. Pictures, photographs, and lantern slides also had a conspicuous place in the school's equipment. The instrumental study of the earth's atmosphere was taken next by the students, who kept records of their own observations for a period of three months. The official weather charts could be obtained daily at every school, and, owing to the area covered by them, it was possible to follow cyclonic and anti-cyclonic disturbances for several days together, and sometimes to predict in the school itself the arrival at a particular time of an atmospheric disturbance. Field excursions were regarded as the most important part of geographical study. The progress of the teaching of geography in the United States had been most encouraging.

The discussion which followed was taken part in by Sir Thomas Holdich, Mr. Dickinson, Mr. White, and others.

The annual report of the Association was then presented by the Committee, and showed that a steady increase in the number of members has occurred in the past year. While 21 members have been lost by death or resignation, 123 new members have joined, making the total membership 448.

Admiral Sir Erasmus Ommanney, K.C.B., F.R.S.—The death of Admiral Sir Erasmus Ommanney, at the advanced age of ninety years, has removed an interesting link with the past of geographical exploration. Erasmus Ommanney entered the navy in 1826, and in 1835 volunteered to serve under Sir James Ross in the voyage for the relief of a number of missing whalers, believed to be caught by the ice of Baffin's Bay, and on the coasts of Greenland and Labrador. The expedition was successfully carried out in spite of the great difficulties experienced owing to the season of the year, and for his part in it Lieut. Ommanney received the commendation of the Admiralty. In 1850 he was appointed second in command under Captain Austin in the Franklin Relief Expedition, and was given H.M.S. *Assistance* with the *Intrepid* as tender. Captain Ommanney was fortunate enough to be the actual discoverer of the first winter quarters of Franklin's ships, and undertook a very extensive series of sledge journeys, by means of which the coast of Prince of Wales Land was laid down. On his return he was elected a fellow of the Royal Society for his services to science. Subsequently he also became a member of the Royal Geographical Society, and was an active member of the British Association. His death took place on December 21.

Sir John Murray, K.C.B., F.R.S., has been elected Honorary Member of the Society of Geography of Geneva in place of the late Sir H. M. Stanley. Sir John Murray has also been awarded the Count Lüthe Medal by the Russian Geographical Society.

Mr. A. Silva White, formerly Secretary of the Royal Scottish Geographical Society and Editor of this *Magazine*, has been appointed assistant secretary of the British Association.

Commercial Geography

Coal Deposits in Alaska.—According to the *National Geographic Magazine*, a recent survey has proved that the coal deposits of the Arctic coast of Alaska, near Cape Lisburne, are much thicker, more numerous, and more extensive than has been supposed. Coal-bearing beds are known both in Mesozoic and in Palæozoic beds. The deposits of the former age begin at a point 25 miles east of Cape Lisburne, and are continuously exposed along the coast to Cape Beaufort, a distance of 40 miles. The coal-bearing strata have a total thickness of at least 15,000 feet, and contain not less than forty beds of coal, each over a foot thick. The aggregate thickness of all the beds seen is over 150 feet. Eleven of the beds are more than four feet thick, and contain coal of good

quality, while of the others some have proved on analysis to contain low-grade bituminous coal. None of these coal-beds have been permanently developed. The relatively small quantities of coal which have been hitherto obtained have been mined from the outcrop on the sea-cliff, and conveyed in boats through the surf to the ships. There is no harbour for vessels. The Palæozoic beds occur south of Cape Lisburne, and are quite as extensive as the Mesozoic beds, though as yet they are entirely undeveloped. The coals appear to be bituminous, and are of considerably better quality than the Mesozoic coals.

Cotton in the West Indies.—The area planted with cotton this season in the West Indies is estimated at from eight to ten thousand acres, excluding Carriacou, where four thousand acres are planted mostly with Marie Galante cotton. Of this amount Barbados and St. Vincent each have sixteen hundred acres under cotton, and in St. Kitts the acreage exceeds two thousand acres. The crops generally are much healthier than those of a year ago, and an output of about 5000 bales is expected.—*Agricultural News.*

NEW BOOKS.

EUROPE.

The Survey Atlas of England and Wales. A series of 84 Plates of Maps and Plans, with Descriptive Text, illustrating the Topography, Physiography, Geology, Climate, and the Political and Commercial Features of the Country. By J. G. Bartholomew, F.R.S.E., F.R.G.S. Published at the Edinburgh Geographical Institute under the patronage of the Royal Geographical Society. 1903.

In the *Magazine* for April 1903 a welcome was accorded to the prospectus of this work, which promised to be a compendium of a very valuable character, intended to bring together all available information in regard to topographical geography and other scientific operations which have been carried out in England and Wales by various departments of the Government. Then, also, and again in February 1904, on the issue of some of the topographical sections, hearty recognition was given to the highly artistic drawing of the topography and the general excellent execution of the maps.

Now, on the completion of Mr. Bartholomew's labours and the issue of the entire atlas, it is due to the talented editor that there should be rendered to the work he has produced a full measure of praise for its high quality throughout, as well as for its comprehensive character.

Of the various contents, the first in importance to be mentioned are the topographical sections—sixty-seven in all—which follow closely, as far as the reduced half-scale will allow, the one inch to a mile sheets of the Ordnance Survey. But Mr. Bartholomew has not been content to accept these sheets as if they were all fresh surveys recently executed, and he has taken great pains by reference to local authorities to bring his sections up to date by the addition of new railways, roads, or other constructions, and the deletion of those which no longer exist. For the drawing of the sections there were splendid examples in the one-inch engraved sheets of the Ordnance Survey, which, for clearness of delineation of all the

features and for the excellence of the shaded representation of the hills, can hardly be surpassed. But in using lithography Mr. Bartholomew has been able to adopt different colours for different gradations of ground and varying shades in the colour of the hills, which has furnished the means of representing all the features more effectively than can be obtained from an engraving printed in one colour. His sections, therefore, are for quick discernment of the face of the country most telling interpretations of the Ordnance Survey Sheets, and they are beautiful specimens of colour lithography. The sections will be found for most purposes to contain all essential details, and the reduced scale of half-inch to a mile has the advantage for general use over the one-inch scale that a much larger area is brought together on one map.

To mention next the specially compiled maps indicated in the title of the Atlas, of which there are eleven, all will be found of great value for studying the sciences or lines of scientific inquiry to which they refer. Colour lithography has been used throughout, and on the map illustrative of Physiography the introduction of the depths of the seas and straits surrounding our Island adds greatly to the interest of a study of the prominent features of the land. The geological map furnishes a very complete and clear statement of the great variety of formations and strata of which the Island is composed. But all the special maps, of which there are nine others, are both interesting and instructive, furnishing valuable information on:- Rainfall, Temperature, Railways, Density of Population, Commerce, Industries, and Political and Ecclesiastical Divisions. Nothing further need be said of the descriptive texts on Physiography and Geology, than that the author of the one is H. R. Mill and of the other Sir A. Geikie, which is sufficient to stamp their high scientific character. In the Glossary showing the etymology of place names, much of interest is found regarding the languages of the different peoples who formerly occupied separate parts of the Island. There still remain to be mentioned the very elaborate Statistical Tables concerning Population, Manufactures, Agricultural Products, Industries, and the Political and Ecclesiastical divisions of the people, which further indicate the comprehensive scope of the Atlas.

In this Atlas Mr. Bartholomew has rendered distinct service to geographical science, not only by the care and talent with which he has carried out the cartographical work, but also by the addition of special maps, descriptive texts, and statistical statements, bearing on allied subjects, all of which are now being recognised as proper adjuncts to a complete study of geography.

Mediterranean Winter Resorts. By E. A. Reynolds-Ball. Fifth edition. London: Hazell, Watson, and Viney, 1904. Pp. 618. *Price* 6*s.*

A new, enlarged edition of this little book appears to remind dwellers in the North that sunnier skies are to be found. "Comparing Nice with London," says the author, "we find that during six winter and spring months, Nice has an average of ninety-seven clear and cloudless days, while London has only twelve." We should like, however, to see a comparison made not between vast and necessarily smoky London and the comparatively rural Nice, but between the latter and some well-known sunny town on the English south coast, such as Hastings or Bournemouth. The author wisely remarks that it is a mistake to suppose that *warmth* is the most characteristic feature of the climate of the French Riviera, the average mean temperature there during winter being not more than about 10° higher than in England. He does not mention what part of "England"—rather a large term. The present writer has seen during April the famed Monaco and Monte Carlo wrapt in as cold a "Scotch haar" as Edinburgh ever knew, while simultaneously for a

week Mentone was shrouded in mist. We observe that this edition still retains the misleading variations of temperature at Luxor in Egypt, although, when reviewing the fourth edition in 1899 (vol. xv. *S.G.M.*, 503) we pointed out that, between the day and evening temperatures at Luxor, the variation may be as much as 20° or 30°—an important difference for invalids. Otherwise, the book is brimful of valuable information on nearly every health-resort in Southern Europe, Northern Africa, the West Indies, and India.

Stanford's Geological Atlas of Great Britain, with Plates of Characteristic Fossils; preceded by a Description of the Geological Structure of Great Britain and its Counties, and of the Features observable along the principal Lines of Railway. By HORACE B. WOODWARD, F.R.S. London: E. Stanford, 1904. Pp. 139, and 50 Maps and Plates. 12*s.* 6*d. net.*

One of the most interesting and instructive contributions to the study of British Geology, this handy work, with its carefully prepared letterpress and beautifully executed maps, furnishes a key to both the Geology and Geography of Great Britain at a small cost considering the expense of producing thirty-four multi-coloured geological maps. Perhaps its most novel feature is describing the geology observable from the windows of British railway carriages. Here is what we see from those of the—

"NORTH BRITISH RAILWAY Map 34). From Berwick to Burnmouth we continue at a high level above cliffs in the Lower Carboniferous rocks, here mostly red sandstone, with Silurian slaty rocks on the west. We now pass inland on to the Old Red Sandstone at Ayton and Reston Junction, and over portions of the Lammermuir Hills, formed of Silurian rocks, by Grant's House. From Cockburnspath to Dunbar we traverse the Lower Carboniferous rocks, and hereabouts we may have glimpses of the Bass Rock. From East Linton we traverse a region of eruptive rocks which extend to Drem Junction, and include North Berwick Law, a volcanic vent which rises to the north. Thence we pass over Lower Carboniferous rocks to Edinburgh, with a tract of Coal-measures (the Midlothian Coalfield) at Musselburgh. The noble heights of Arthur Seat and other crags in the vicinity of the city are formed of igneous rocks of Lower Carboniferous age.

"From Edinburgh to the Forth Bridge, and onwards for some distance past Dunfermline, we continue on Lower Carboniferous strata with many eruptive rocks. On the borders of Loch Leven and at Kinross we are on the Old Red Sandstone, while eastwards rise the volcanic rocks of the Lomond Hills; and we proceed on the Old Red Sandstone to Cupar, crossing a volcanic area before reaching the Tay Bridge.

"Map 33. From Dundee to Stonehaven we again traverse Old Red Sandstone, with sand-hills between Broughty Ferry and Carnoustie, and volcanic rocks near Montrose. Beyond Stonehaven we come into the region of Highland Schists, and finally reach Aberdeen with its huge quarries of grey granite."

ASIA.

The Persian Gulf and South Sea Islands. By Sir EDGAR C. BOEHM, Bart. London: Horace Cox, 1904. Pp. 180. *Price* 6*s.*

In very popular language the author describes his voyage up the Persian Gulf and his visits to Bagdad and Babylon, and to the remarkable Rock carvings in Persian territory, near Sherpore, believed to be 3000 years old. Then he

sailed to New Zealand, where, in Dunedin, he thought he was in Scotland, "for everywhere around the voices you hear are nearly all broad Scotch." He found railway travelling in New Zealand slow and uncomfortable. "The carriages are very badly built, and the first class equals the third of any other country." His tour included the South Pacific Isles, and his book is well illustrated, although its photographic pictures of Fijian cannibals at their gruesome work must have been "got up," for the Fiji group was annexed to the British Empire in 1874, and cannibalism has ceased.

By Nile and Euphrates. By H. Valentine Geere. Edinburgh: T. and T. Clark. 1904. *Price* 8*s.* 6*d.*

Mr. Geere's book is not a scientific record of the excavating expeditions in which he took part, but he amply fulfils what he undertook, viz., "to give some idea of an excavator's camp and a sketch of certain out-of-the-way places and their inhabitants." Whether he accomplish his further object of arousing greater interest in the cause of Babylonian research or not, he at least makes a spirited appeal on its behalf, and most of his readers will be sorry if Britain should not continue to take a share in excavating work in that part of the world. The expedition of which Mr. Geere was a member was sent out by the University of Pennsylvania to conduct excavation work at the ancient city of Nippur in Mesopotamia. He made two journeys there, but between these he also did a season's excavating at Deshasheh and Oxyrhynchus under Professor Petrie and others. The contrast between the comparative ease and comfort in which such work is carried on in Egypt compared with the difficulties and even dangers attached to it in Asia Minor is markedly brought out in Mr. Geere's book and serves to illustrate the change which has come over the former country since it came under British influence. Nevertheless Mr. Geere is a staunch supporter of exploration in Assyria and Babylonia, and has a strong belief in its possibilities. He does not conceal his regret that we have no Society to do there the work which the Egypt Exploration Fund is doing in Egypt. In his view the money would be well spent even from a political view, and he urges that if such work is now left to German expeditions it is not to be wondered if they become, so to speak, outposts for their nation, with the result that the impression of former good work done by Britain in the country is gradually forgotten.

The book is written in an easy and unassuming style. A tour in Egypt or Palestine is now an everyday undertaking, even for those who have no pretensions to be travellers, but Mr. Geere is off the beaten track, and his description of the scenery and inhabitants of these out-of-the-way regions is always interesting. When he is describing excavating work itself, it is easy to see he has not only the excavator's enthusiasm, but realises also that it is only by careful attention to scientific order and method that such work can be successfully carried on. The book contains a number of useful maps and photographs.

AMERICA.

"*Les États-Unis au XX^e^ siècle.*" By Pierre Leroy-Beaulieu. Paris: Librairie Armand Colin, 1904. Pp. 469. *Price* 4 *francs.*

This work is a careful analysis and a lucid exposition of the position of the United States at the beginning of the twentieth century, with special reference to its industrial and commercial prospects and possibilities. M. Leroy-Beaulieu has not only studied all the contemporary literature, including magazine and

newspaper articles, bearing on the subject, but has also paid a visit to the country he writes about, with the purpose of making a personal investigation. The result is, as he says in his preface, a complete inventory of the forces and resources with which the United States is equipped at the moment when the St. Louis Exhibition is commemorating the centenary of the incorporation of the old French territory of Louisiana with the former English colonies. The supremacy of the iron and coal trades have already passed, and that of the cotton trade will soon pass, he says, from England to America, who will also soon oust France from the first place in the silk trade. These things are in the present and the near future, but the author seems to look ahead to a time when the United States will monopolise all the industries and all the commerce of the world. M. Leroy-Beaulieu was evidently very hospitably treated during his visit, and consequently looks upon the subject from the point of view of an optimistic Yankee. As an orthodox economist, he owns that the fiscal policy is not sound, and states, without wearying his readers by reiterating the old arguments that the prosperity of the country is due to free trade within, and not to protection without, but protection and trusts he looks on as merely ephemeral evils. The only cloud he does see looming over the future is indeed a very dark one, in a double sense: he cannot see any satisfactory solution possible of the negro problem. His admiration of the people of the United States knows no bounds. He argues that as the emigrants from any place are usually the most energetic and most able of the population, therefore the people of the United States are the very flower of the European populations, by which he seems to imply that the most able and energetic members of a decayed Polish, Italian, or Hungarian community are the flower of European peoples. Putting aside, however, his glowing forecasts and unstinted praise, his book is invaluable to any one wishing to learn what the present state of America is. Though M. Leroy-Beaulieu necessarily deals largely with statistics, his clear and pregnant style makes even that portion of his work interesting, while his graphic descriptions of the various industries, from the supply of energy at Niagara to the pork packing at Chicago, are most excellent reading. Altogether, this book is well worthy of the author's already high reputation as a careful observer, a deep thinker, and an able exponent of his thoughts.

The Countries of the King's Award. By Colonel Sir Thomas Hungerford Holdich, K.C.M.G., K.C.I.E., C.B., Vice-President of the Royal Geographical Society. London: Hurst and Blackett, Limited. 1904.

Those of our readers who remember the brilliant and eloquent address by Colonel Sir Thomas Holdich on the subject of the Patagonian Andes in the Synod Hall in December 1903, will know what to expect in this volume on "the Countries of the King's Award," and they will not be disappointed. In this elaborate and interesting work Sir Thomas has put on record impressions and observations about Argentina and Chile, which are the result of the three years' sojourn he made in these South American lands, and for the formation of which he had exceptional qualifications and advantages. The fact that the boundary between Argentina and Chile was to a large extent undefined had been for years a serious cause of friction and trouble between the two republics, and apparently the only possible way of finally settling the dispute was war, the results of which, to one or other, if not to both of the republics, must have been disastrous in the extreme. Happily the good sense of the governments of both countries led them to adopt a simpler and more peaceful method of arranging their differences, viz., arbitration, and the question of defining the boundary was, as is well known, made over by mutual consent to King Edward VII. Thus Sir Thomas, coming as

his agent and representative, came as the ambassador and guarantee of peace, and in this capacity he was gladly welcomed by both the great South American republics, and everything that could be done to facilitate his progress and assist him in his arduous and responsible task was cheerfully and cordially done wherever he went. His own personal qualifications for such a work as the demarcation of a disputed frontier are well known and probably unique. He had had great experience in India in the actual work of demarcation ; his technical attainments as a scientific geographer are exceptional ; his personal tact and skill in diplomacy had been well tested ; his firmness and fertility of resource in dealing with difficult circumstances were well known ; his courage and physique were more than equal to the difficulties and dangers which were sure to be encountered in the performance of a task which entailed on him spending several seasons of toil and hardship in the Cordilleras ; and he could be depended on to inspire into his subordinates the same zeal and enthusiasm which he himself brought to the work. It is unnecessary to repeat what has been already said in the *Magazine* and elsewhere as to the ability and success with which he discharged the important duty confided to him. In this work a good deal of light is thrown upon what were the circumstances under which the work was carried out and the difficulties, topographic, climatic, etc., which he encountered. But the great interest of the work lies in the information it contains regarding the present economic conditions of the two South American republics, and the suggestions and recommendations which Sir Thomas makes regarding their future prospects and policy. It is clear that their future depends, much, if not principally, on the emigrants who shall go out to them, and in this respect no one European community has a monopoly of interest ; for both republics receive immigrants from nearly all the emigrating nations of Europe. British emigrants, however, seem to prefer the republic of Argentina to that of Chile, although, according to Sir Thomas, "The Chilean is more Anglo-Saxon than Latin in his national proclivities, and more British than Teuton in his Anglo-Saxon idiosyncrasies." To any one who contemplates emigration to South America we would most cordially recommend a careful perusal of this thoughtful and well-balanced description of Argentina and Chile, in which the advantages and difficulties and economic conditions of each country are set forth with an impartiality and distinctness that leaves nothing to be desired. Sir Thomas wields the pen of a ready writer, one who, having a thorough mastery of his facts and subject, has no difficulty in laying them before his readers in clear and graceful language ; and he has the faculty of describing scenery in vivid and picturesque terms, which, added to the many excellent illustrations by which the work is embellished, enables the reader to form a good idea of the magnificence of the scenery through which he travelled. He has no exciting stories to tell of personal adventures while he was at work on the frontier, but his book is enlivened with occasional episodes, such as the story of the career of the gallant Huascar, or that of the outlaw Ascension Brunel, or of the Welsh colony in the Chubut valley, which only evoke from the reader a regret that there are not more of them. The reader remarks with pleasure that every chapter in the book shows that the writer and his work were highly and justly appreciated alike by the authorities and by the people of the Argentine and Chilean republics ; and that he in his turn was not slow to reciprocate the kindness and courtesy which he everywhere received. The arbitration has been an unqualified success, and all who read this book will easily understand the reason why. We venture to suggest, that in any future edition of this book the publishers should insert a map of the tracts through which Sir Thomas travelled, as the want of it undoubtedly detracts from the usefulness of the work and the pleasure of its perusal.

AUSTRALASIA.

A Statistical Account of Australia and New Zealand, 1902-3. By T. A. Coghlan. Published by Authority. Sidney: 1904.

This is the tenth issue of the useful handbook which has previously appeared as "A Statistical Account of the Seven Colonies of Australasia." As compared with the ninth issue, some additional chapters have been added, and the scope of others has been enlarged. The volume now contains a great mass of information in regard to the colonies.

Western Australian Year-Book for 1900-3 (*being the Second Volume of the Year-Book for* 1900-1), with complete Information and Statistics to the end of 1903. Twelfth edition. By Malcolm A. C. Fraser. In 2 vols. Vol. II. Perth: 1904.

This Year-book, which has been delayed from a variety of causes, contains information as far as possible up to the end of 1903. Among the features of special interest in the issue are a chapter on population and vital statistics, which includes the results of the Census of 1901, an article on Government railways by the Commissioner of Railways, and a chapter on mineral production by the Government Geologist. The chapter on population and vital statistics is unusually full. A great increase in the population occurred in the years between 1891-1901, the population at the 1901 census being 184,124, of which 112,875 are males and 71,249 females. This is a total increase of 134,342 as compared with 1891. This large increase is chiefly due to immigration, the excess of immigrants over emigrants for the year 1896 being 35,891, a figure which marked the high-water mark. Three years later, in 1899, the number of departures actually exceeded the number of arrivals by nine, but in 1901 the excess of immigrants again rose to 11,982. The total number of births (exclusive of still births) for the period 1892-1901 was 36,573, of whom 18,718 were males and 17,855 females. This corresponds to a rate of 28·92 per thousand of mean population, but owing to the fluctuations of the population the rate shows considerable variation for the different years included in the period.

GENERAL.

Earthquakes in the Light of the New Seismology. By Clarence Edward Dutton, Major, U.S.A. London: John Murray, 1904. Pp. ix+314.

Handbuch der Erdbebenkunde. By August Sieberg. Braunschweig: Friedrich Vieweg und Sohn, 1904. Pp. x+360.

These two volumes treat ostensibly of the same subject. They have much in common, but they differ very markedly in the whole method of treatment. Since the publication of Professor Milne's *Seismology*,[1] accumulation of records and discussion of their meaning have gone on apace; and probably the books now before us will be more or less behind date in a few years. The broad feature which distinguishes these, along with Milne's book just mentioned, from former systematic accounts of earthquake phenomena is the recognition and detailed discussion of what has been called microseismic vibrations. Large sections are devoted to the description of the delicate instruments invented for recording the minute pulsations and vibrations which every great earthquake sends through the whole mass of the earth. This part is treated with great fulness in the German work. Then naturally comes the discussion of the records obtained by the instruments, and finally the conclusions derived from a scientific study of

[1] See "The New Seismology," vol. xv. of this *Magazine* (1899).

the statistics. The questions of distribution in space and time, the influences which modify earthquake activity, and the more fundamental question as to the source of earthquakes, are taken up more or less fully by both authors. Of the two books, we should regard Mr. Dutton's as the more readable and better fitted for the ordinary man, whose desire is to know the broad lines along which Seismology has developed in recent years. Dr. Sieberg's book, however, is more of a treatise and enters more particularly into the nature of the observational data and the methods of working them up. In this sense his work is the more complete; it abounds in pictures and diagrams, and gives very full references to original sources. Not that the English treatise is remiss in these particulars. It is less of a compendium of facts and statistics; but it shows a fine discrimination in choosing those aspects of the subject which at present bear most directly upon the fundamental questions of the nature and cause of earthquakes and the interior condition of the earth. The American author has aimed at indicating the important lines of development. Dr. Sieberg, on the other hand, has laboured to present the student with a general outline of the whole subject, his individual views being kept in the background. Both authors have done their task admirably and have notably enriched the literature of Seismology.

From a Holiday Journal. By Mrs. E. T. Cook. London: George Allan, 1904. Pp. 217. Illustrated with 6 Colour Sketches and 6 Photogravures.

We doubt if it was worth while to gather these magazine articles in book form. Occasionally the authoress strikes something curious, as in the account of the Sanctuary (it is really a Sanatorium) of the Sacro Monte at Varallo. But most of the papers are of personal and ephemeral interest. That on the Upper Thames is the best. The slips of the first publication should have been corrected in the book, but this has not been done. The illustrations are excellent. The poetry is not always of the same rank.

Dodge's Elementary Geography. By R. E. Dodge, New York. Published by Rand M'Nally and Co. Pp. 231.

This is a school-book for the U.S.A., and we have other school-books here. The design of the book is ambitious, but is it possible for any child to master this mass of heterogeneous information? If we may take the portion of the book which deals with these islands as typical of the whole, we should say that the result is not locally satisfying. For instance, how do Members of Parliament, as a body, like being called "the officers of the Government"? Further, with all deference to the editor and Webster's *Pronouncing Dictionary* a Scotch loch is not correctly called a *lok*. In reading these pages we are constantly reminded that the writer is a stranger and hence, unconsciously, we perhaps do injustice to his real knowledge. For whoever has mastered all the book contains will pass as a pundit in most companies. Practically every page is illustrated, and there are numerous coloured maps.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

Wander-Years Round the World. By James Pinnock. With Maps and Illustrations. Demy 8vo. Pp. xvi + 349. *Price* 21*s. net.* London: T. Fisher Unwin, 1904.

Sociological Papers. By Francis Galton, E. Westermarck, P. Geddes, E. Durkheim, Harold H. Mann, and V. V. Brandford. With an Introductory Address by James Bryce, President of the Sociological Society. Super-royal 8vo. Pp. xviii + 292. *Price* 10s. 6d. London : Macmillan and Company, Ltd., 1904.

On the Track of a Treasure: The Story of an Adventurous Expedition to the Pacific Island of Cocos. By Hervey de Montmorency. With Illustrations and a Chart. 8vo. Pp. x + 290. *Price* 6s. London : Hurst and Blackett, 1904.

Dodge's Elementary Geography. Small quarto. Pp. 231. *Price* 65c.

Dodge's Advanced Geography. Small quarto. Pp. 333. *Price* $1, 20c. By Richard Elwood Dodge. Chicago : Rand, M'Nally and Company, 1904.

The Tower of Pelée: New Studies of the Great Volcano of Martinique. By Angelo Heilprin, F.R.G.S. Quarto. Pp. 62, with additional 22 Full-page Illustrations. Philadelphia : J. B. Lippincott Company, 1904.

Wellcome's Photographic Exposure Record and Diary for 1905. Pp. 266. *Price* 1s. London : Burroughs Wellcome and Company, 1905.

Grundriss der Handelsgeographie. Von Dr. Max Eckert. 2 vols. Pp. Band I., xi + 229 ; Band II., xvi + 517. Leipzig : C. J. Goschen, 1904.

Also the following Reports, etc :—

Year-Book of the Scientific and Learned Societies of Great Britain and Ireland: A Record of the Work done in Science, Literature, and Art during the Session 1903. Compiled from Official Sources. Twenty-first Annual Issue. London, 1904.

Summary Report of the Geological Survey Department of Canada for the Year 1903. Ottawa, 1904.

Annuario Statistico Italiano 1904. Roma, 1904.

Statistica della Emigrazione Italiana per l'Estero negli Anni 1902 *e* 1903. Roma, 1904.

Second Report of the Geological Survey of Natal and Zululand. By William Anderson, F.R.S.E., F.G.S. London, 1904.

Catalogue of Canadian Birds. Part III. By John Macoun, F.R.S.E. Ottawa, 1904.

Nests and Eggs of Birds found breeding in Australia and Tasmania. By Alfred J. North, C.M.Z.S. Vol. I. Sydney, 1904.

Annual Progress Report of the Archæological Survey of Madras and Coorg for the Year 1903-4. Madras, 1904.

Administration Report of the Marine Survey of India for the Official Year 1903-4. Bombay, 1904.

Report on the Administration of the Meteorological Department of the Government of India, 1903-4. Calcutta, 1904.

Report on the Administration of Coorg for the Year 1903-4. Mercara, 1904.

General Report on the Operations of the Survey of India administered under the Government of India during 1902-3. Prepared under the direction of Colonel St. G. C. Gore, C.S.I., R.E. Calcutta, 1904.

Report of the Department of Lands and Survey, New Zealand, for the Year 1903-4. By J. W. A. Marchant. Wellington, 1904.

Cyprus Blue-Book, 1903-4. Nicosia, 1904.

Sudan Almanac, 1905. I.D.W.O., Cairo, 1905.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

BOTANICAL SURVEY OF SCOTLAND.

III. AND IV.—FORFAR AND FIFE.

By WILLIAM G. SMITH, B.Sc., Ph.D., University of Leeds.

(*Continued from page* 83.)

VEGETATION OF MARSHES AND BOGS

FREQUENT records of this vegetation were made during the botanical survey of Perth, Forfar, Fife, and Edinburgh. Two extreme types, the marsh and the bog, stand out on examining the notes, and between these there is every stage of transition. The typical bog prevails in the heather area, and the vegetation consists of peat-forming and peat-frequenting plants. Mosses (e.g. *Sphagnum*, *Polytrichum*, and *Aulacomnium*) play an important part in the early stages of the formation of a bog. The flowering plants include Ericaceæ (*Calluna*, *Erica*, *Vaccinium*), Cyperaceæ (*Eriophorum*, *Eleocharis*, *Scirpus*, and the smaller species of *Carex*), Grasses (*Molinia*, *Nardus*), Crowberry (*Empetrum*), Bog Myrtle (*Myrica*), Butterwort (*Pinguicula*), Sundews (*Drosera*), Bog Asphodel (*Narthecium*), etc. The marsh vegetation includes the taller species of Sedges, Rushes, and Grasses, with other plants such as Marsh Marigold (*Caltha palustris*), Cuckoo Flower (*Cardamine pratensis*), Ragged Robin (*Lychnis Flos-cuculi*), Meadow-sweet (*Spiræa Ulmaria*), Willow-herbs (*Epilobium hirsutum* and *E. palustre*), Dropworts (*Œnanthe fistulosa* and *Œ. crocata*), Marsh Bedstraw (*Galium palustre*), Marsh Ragwort (*Senecio aquatica*), Forget-me-nots (*Myosotis cæspitosa* and *M. repens*), Marsh Docks (*Rumex conglomeratus*, *R. domesticus*, *Polygonum amphibium*, and *P. Hydropiper*), Marsh Orchids (*Epipactis latifolia*, and *Orchis latifolia*), Willows (*Salix*), and Alders (*Alnus*).

A comparison of the representative plants shows that the bog plants are generally slow in growth and low in stature, whereas the marsh plants grow rapidly and either attain a considerable height, or, if low, produce many leaves and shoots in a single season. In other words, the annual increment of plant material in the marsh is large, while in the bog it is small. The marsh as here defined corresponds with what many continental botanists distinguish as Wiesen-moore or Sumpf-moore; our bog is their Sphagnum-moore or Moos-moore. According to Warming (1896), the fundamental distinction is that the marsh vegetation grows in water which is richer in food materials, especially lime, and the peaty matter formed contains a muddy deposit and yields a large percentage of ash; whereas, in the bog, the water is poor in lime and other mineral salts, while the peat is almost entirely made up of plant remains and yields little ash. The influence of the substratum on the same species of plant we have observed in the case of a grass—*Molinia varia*. It is frequent as a social plant on the upland peat-moors of Scotland and Yorkshire, and also in the lowland Fen marshes (*e.g.* near Cambridge). On the upland moors this grass rarely attains to more than two feet in height, while in the Fens it is four or five feet high and occurs with other species of large plants. When dealing with aquatic vegetation, it was indicated that the rich vegetation of the lowland lochs, and the scanty plant-growth in the highland type of loch, might be ascribed to the amount of available plant-food in the water. This is borne out when one compares the general distribution of marsh and bog. Typical marshes occur on the landward side of the reed-swamp of lowland lochs and rivers, and typical bogs occur beside many of the highland lochs. A list of plants from the Tay marshes has already been given (p. 81), and this might be added to from Mr. Barclay's papers (1890 and 1891). My brother had also prepared notes on the marsh plants round the Rescobie group of lochs. There is a marked agreement between the Tay and Rescobie marsh vegetation, not only in the species present, but also in the absence of distinctive bog-plants from all the lists. The typical marsh vegetation is related to, and cannot be sharply defined from, the reed-swamp, and the distribution of both types is lowland.

The plants characteristic of bogs have a wide altitudinal range. They occur almost at sea-level on Tentsmoor and other localities, and all over the Sidlaws and Ochils where the soil conditions are suitable, while on the Grampians in the districts of Clova and Caenlochan they have been recorded up to altitudes varying from 2000 to 3000 feet. Bog vegetation is found on closer examination to be far from uniform; it is made up of distinct associations of plants whose distribution is determined by edaphic factors. This may be shown by a definite case. My brother gave considerable attention to a small marsh at Forgan (near Tayport, Fife), which he believed to be primitive and little influenced by man. It lies in a natural depression (about 70 feet altitude) surrounded by level pasture-land, except on the southern side, where there is a hill of glacial sand and gravel covered with grasses and whin. There is no inflow stream, and water is supplied partly from springs in the depres-

sion, partly from surface drainage. A small outflow stream drains the eastern end. There is evidence that the marsh was at one time on the coast, or much nearer it than now. The water is liable to seasonal fluctuation; but that the marsh is rarely dry is indicated by the presence of some pools of open water in which grow Pondweed (*Potamogeton natans*), Water-buttercup (*Ranunculus hederaceus*), and Bladderwort (*Utricularia*, three species). The marsh as a whole may be described as a Caricetum, since it is mainly occupied with tussocks of sedges (*Carex rostrata*, *C. flava*, *C. disticha*, *C. panicea*, and *C. paniculata*) and other sedge-like plants. Here and there amongst the sedges are distinct islands rising slightly above the level of the marsh, consisting chiefly of the mosses *Sphagnum* and *Aulacomnium*. The *Sphagnum* grows first in the open pools, and gradually fills these up till mossy patches are formed standing above the usual water-level. The plants of Forgan marsh are sharply divided into two groups: those amongst the tussocks of *Carex*, and those on the islands of *Sphagnum*. The following were recorded in this way:—

Amongst *Carex*.	On *Sphagnum* Islands.
Ranunculus Flammula, L.	*Viola palustris*, L.
Caltha palustris, L.	*Potentilla palustris*, Scop.
Cardamine pratensis, L.	*Drosera rotundifolia*, L.
Lychnis Flos-cuculi, L.	*D. anglica*, Huds.
Epilobium palustre, L.	*Schollera Oxycoccus*, Roth.
Hydrocotyle vulgaris, L.	*Erica Tetralix*, L.
Galium palustre, L.	*Pedicularis palustris*, L.
Cnicus palustris, Willd.	*Narthecium Ossifragum*, Huds.
Menyanthes trifoliata, L.	*Sphagnum*, spp.
Juncus acutiflorus, Ehrh.	*Aulacomnium palustre*, Schwg.
Triglochin palustre, L.	
Eleocharis palustris, R. Br.	
Eriophorum angustifolium, Roth.	

The plants of the *Sphagnum* islands are characteristic peat-bog forms, and introduce a bog element into a vegetation which is mainly of the marsh type. The plants of the *Carex* association are all included in Mr. Barclay's lists for the Tay marshes, while the species recorded for the *Sphagnum* islands are almost all absent from these lists; exceptions are the species of *Pedicularis*, *Viola*, and *Potentilla* given above, and of these Mr. Barclay states that the two latter species he found only sparingly. *Sphagnum* islands have already been referred to in Northern Perthshire (1900 B, p. 25 and figure). The photograph there reproduced shows a marshy pool occupied by sedges and rushes, and with a *Sphagnum* island on which are pine seedlings, ling, and other peat plants.

These observations give a clue to the development of moorland vegetation in Eastern and Central Scotland. For a time following the Glacial Period it is probable that a vegetation resembling the tundra of Arctic Northern Europe and Siberia occupied the soil. This may be

briefly described as resembling in its main features the Grampian summits of the present time. Mosses and lichens prepared a substratum which was occupied in course of time by low shrubby plants of the ling and Arctic willow type, and by tufts of bristle-leaved grasses. Slopes which were fairly well drained would gradually assume the heather moor, grass heath, or *Vaccinium* type of vegetation, with or without forest. Where water collected, the plants would be limited to such as are adapted to an existence on a substratum which is more frequently water-logged than dry, and where defective drainage promotes the accumulation of organic acids. The gradual sorting out of areas is indicated by what is taking place at present on the Cleish Hills (*see* p. 23). The bog moss (*Sphagnum*) where it established itself would promote the formation of peat, and prepare the way for the growth of other mosses, also peat-formers, and the deeper peat thus formed would favour heather, the peat grass (*Molinia varia*), cotton grass (*Eriophorum*), and other peat plants. Where, however, the developing peat was liable to be flooded and covered with deposits of muddy silt, peat formation would be retarded, and the substratum formed would contain a larger amount of mineral matter than the peat deposits. This would favour plants of the marsh type and a vegetation characterised by sedges or rushes would result. The present vegetation is a result of this struggle. On almost any area of wet moorland, the dark-coloured mass of peat plants is broken by tracts of lighter-coloured vegetation. These consist generally of rushes (*Juncus*) or sedges (*Carex*), and their situation is in a hollow, probably the headwaters of a stream, where running water brings more abundant supplies of mineral food and occasional washes of silt. These associations of rushes and sedges occurring in boggy areas may be distinguished as "Bog-Junceta" or "Bog-Cariceta" according as the species of *Juncus* or *Carex* are the dominant forms. The following is a representative list of common plants recorded as occurring on the Sidlaws, Ochils, and Grampians in the Junceta or Cariceta: the asterisk indicates that the species has been found up to altitudes above 2000 feet, in many cases up to 3000 feet; the absence of an asterisk indicates that the highest station recorded in our notes is below 2000 feet.

Social Species.

**Juncus effusus*, L.
**J. conglomeratus*, L.
**J. supinus*, Moench.
**J. lampocarpus*, Ehrh.
J. acutiflorus, Ehrh.
**Scirpus cæspitosus*, L.
Scirpus setaceus, L.
**Molinia varia*, Schrank.
**Carex dioica*, L.
**C. pulicaris*, L.
**C. echinata*, Murr.
**C. Goodenowii*, J. Gay.
**C. panicea*, L.
**C. flava*, L.
**C. rostrata*, Stokes.

Common Species.

Lychnis Flos-cuculi, L.
Galium uliginosum, L.
G. palustre, L.
Menyanthes trifoliata, L.
Veronica scutellata, L.
Pedicularis palustris, L.
Potamogeton polygonifolius, Po.
**Ranunculus Flammula*, L.

**Caltha palustris*, L.
**Cardamine pratensis*, L.
**Stellaria uliginosa*, Murr.
**Montia fontana*, L.
**Potentilla palustris*, Scop.
**Parnassia palustris*, L.
**Drosera rotundifolia*, L.
**Hydrocotyle vulgaris*, L.
**Cnicus palustris*, Willd.
**Pinguicula vulgaris*, L.
**Narthecium Ossifragum*, Huds.
**Triglochin palustre*, L.
**Selaginella selaginoides*, Gray.

The wide range in altitude of these rush and sedge associations distinguishes them from those of the lowland marsh. Their position is intermediate between the typical marsh and bog. This is the case in their geographical range, and also in regard to the vegetative form. The prevailing plant form, the rush-leaf and the sedge-leaf, is more xerophytic in type than the broader-leaved and taller form of typical marsh plants ; this is due to the occurrence of more frequent periods of drought in the bog areas. On Tentsmoor, examples may be found of the three forms of marsh and bog vegetation here distinguished. Wet peat bogs and Junceta or Cariceta occur in old dune hollows, while along the streams and drains where water flows slowly and deposits silt, we have found the majority of the plants recorded for the reed-swamp of the Tay marshes along with other marsh plants (Fig. 12).

The contrast between the vegetation of the marsh and that of the bog is another instance of a contrast which runs throughout all the papers dealing with botanical survey. Equally striking is the contrast between lowland loch and highland loch, grassy moor and heather moor, oak wood and pine wood. The pine wood, heather moor, highland loch, and the bog, represent vegetation with a meagre supply of food, either because the soil is poor or because peat has accumulated over a richer soil. The oak wood, the grassy moor, the lowland loch, and the marsh, are all supplied more abundantly with available plant food. The influence of peat deposits has been referred to in these papers again and again. Peat is in Britain one of the most important substrata poor in plant food. The formation of peat would form a natural conclusion to this part of the paper. We do not propose to deal with it, chiefly because, in spite of many existing papers dealing more or less with peat, we believe that much more remains to be done along the lines of surveys like the present. Mr. F. J. Lewis (1904) has given special attention to the peat deposits in the North of England and on the Scottish Border, and is at present engaged on a survey which promises to throw much light on the composition of peat and on the plants forming it. Dr. Graebner (1901) in a monograph on the heather moors of the North German Plain gives a useful account of his observations on the vegetation of peat, and the conditions which determine its formation. This has already been reviewed at some length in this *Magazine*. *The Origin of the British Flora*, by Mr. Clement Reid, contains numerous records of plant seeds and other remains found in peat and other substrata in Britain. Mr. C. E. Moss (1904) has recently published a historical account of the peat deposits of the Pennines, in which a large number of earlier papers are referred to.

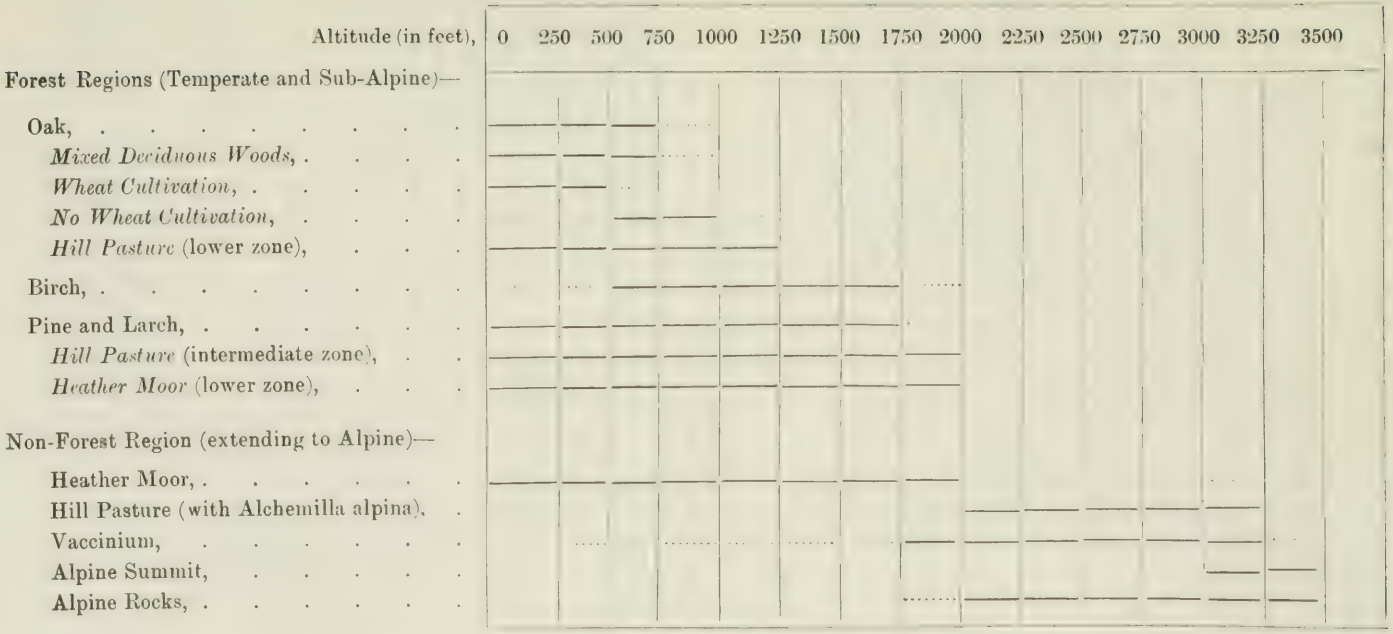
Summary.

The summary of the regions and plant associations given at the end of the paper on Northern Perthshire (R. Smith, 1904 B) is not materially altered by the results of the survey in Forfar and Fife. It may therefore be taken as a summary from the geographical aspect of the area shown on Fig. 1.

The altitudinal distribution of the chief types shown by colours on the maps is presented in another way in the accompanying table. A continuous line indicates the zones where the type referred to is well developed; a dotted line indicates occasional occurrence at a higher or lower altitude.

The distribution of the vegetation considered from an ecological aspect, in its relation to environment, is due partly to climatic factors, partly to substratum. The above table represents approximately the relation between the vegetation and the climate, because increase of altitude in this area is accompanied by an increase in rainfall and a decrease in the mean annual temperature (*see* p. 627), and the upper and lower limits as shown are determined chiefly by climate. Each zone may therefore be regarded as a climatic or district formation as defined by Schimper (1903). Altitudinal and climatic zones fail, however, to account for all the changes from one association to another, and one must seek for other factors to explain them. The influence of the substratum or edaphic conditions is traceable in almost every type of vegetation recorded on the maps; to a greater degree is this the case when seeking for reasons for the occurrence of minor associations. These, although not represented on the maps, have been frequently recorded in recent papers on botanical survey, and as yet no attempt has been made to summarise them. In a summary of the edaphic associations, the poverty or richness of the substratum in available plant food, and the water supply, are important factors. The following summary, based on these, has the advantage that similar schemes have been used by other workers (*e.g.* Graebner, 1901); hence comparisons can be made with other areas. As each association consists of a community of species which has already been recorded, a reference is made to the paper where this list of species is given; these references have been extended beyond the Scottish area to include the botanical surveys in Yorkshire and Westmorland.

Zones of Vegetation.



Italics indicate "substituted associations" occupying the area of the natural association under which they occur (see xx. p. 621).

A. Associations with a water supply comparatively rich in plant food.

I. Forest:

(1) Moist soils:

Oak and Mixed Deciduous Woods.—Soils well provided with food material and with moisture; subject to fairly rapid drainage, yet rarely dry. Representative species—Edin.,[1] pp. 23 to 27; Perth, pp. 8 to 12; Forfar, p. 5 to 8; West., I. p. 7; Yorks., I. pp. 26 to 30. The undergrowth varies according to the shade cast by trees, the texture and moistness of the soil, and the presence of forest raw-humus (T. W. Woodhead, 1904).

The following social species alone or in combination may form undergrowth associations:—Bramble (*Rubus fruticosus*), Rasp (*Rubus Idæus*), Yorkshire Fog Grass (*Holcus mollis*), Bent (*Agrostis* spp.), Sheep's Fescue (*Festuca ovina*), Hair Grass (*Deschampsia flexuosa*), Tussock Grass (*D. cæspitosa*), Wood Hyacinth (*Scilla festalis*), Dog's Mercury (*Mercurialis perennis*), Wood Garlic (*Allium ursinum*), Bracken (*Pteris Aquilina*), Buckler Ferns (*Lastræa Filix-mas* and *L. dilatata*), Heather, Blaeberry, Rushes, etc.

Birch Woods.—Remnants of disforested oak woods, or natural woods above the upper limit of the oak; natural birch soils are poorer than oak soils, and may vary from dry and rocky to wet and peaty.

Scottish Birchwood—Perth, pp. 16 to 19; Forfar, pp. 8 to 10.

Pennine Birchwood—Yorks., I. p. 24; II. p. 19; West., I. p. 7; II. p. 6.

Ash Woods and Hazel Copse on Limestone Soils—Yorks., II. p. 34 to 40.

(2) Wet soils: Alder and Willow Thickets.

II. Grass Lands and other Herbaceous Associations:

(1) Dry or Moist Soils:

Grass Pasture.—Close turf in direct communication with soil, no peat; drainage good, moisture fairly maintained by rainfall or dew; drought may occur. Principal social grasses:—*Festuca ovina, Cynosurus cristatus, Agrostis vulgaris, Deschampsia flexuosa, Anthoxanthum odoratum,* and *Poa pratensis.* The distinguishing feature is the absence of heath plants, and the great variety of species other than grasses. Representative associations:—Lawers pasture (Perth, pp. 30 to 32); Basaltic knolls, frequently with whin, on Pentlands (Edin., pp. 39 to 42), Sidlaws, Ochils, and Fife Hills (Forfar, pp. 17 and 21); Alpine pasture, with *Alchemilla alpina* (Perth, p. 34, Forfar, p. 64); Limestone pasture (Yorks., II. pp. 28 to 30; West., I. p. 10). Transitions from Grass Pasture to Grass Heath occur where drainage is deficient.

Gorse or Whin.—Edin., pp. 41 and 48; Forfar, p. 17.

(2) Wet soils, with accumulation of organic matter:

Marsh.—Forfar, pp. 117 to 121.

(3) In Water:

Vegetation of lakes, streams, and ditches.—Yorks., I. p. 36; Forfar, pp. 78 to 81.

---

[1] The contractions refer to the following papers (the page number is taken from the edition mentioned):—Edin. and Perth, R. Smith (1900 B), Bartholomew's edition; Yorks., I. and II., Smith, Moss, and Rankin (1903, I. and II.), Bartholomew's edition; West., I. and II., F. J. Lewis (1904, I. and II.), reprints from *Geographical Journal*. Forfar is the present paper; page numbers are those of the *Scottish Geographical Magazine*, vols. xx. and xxi.

B. Associations with a water supply poor in mineral matter.

I. Forest:

Pine Woods and Plantations.—Soils poor, chiefly sand or peat, liable to excessive moisture and to drought. Undergrowth variable, according to open or close canopy, texture, and moistness of the soil, and condition of the peat or raw humus. Representative undergrowth associations include few species—(Edin., pp. 29 to 32; Perth, pp. 12 to 20, and 29; Forfar, p. 11; Yorks., II. pp. 24 to 26).

Larch Plantations, pure or mixed with Scots Pine; Larch is excluded from badly drained soils (Forfar, p. 13).

Spruce Plantations.—Pennine Moorland (West., II. p. 5).

II. Heather Moor, Grass Heath and other Herbaceous Associations:

(1) Dry soils:

Vegetation of fixed sand dunes.—Edin., p. 14; Forfar, p. 70.

(2) Moist soils more or less mixed with peaty humus.

Grass Heath: grassy turf, with heath plants present: moisture variable, water retained in soil by peat, but periods of drought occur. Representative minor associations:—

(*a*) *Festuca ovina*, *Agrostis vulgaris*, and *Anthoxanthum odoratum*, with heath plants. — Silurian Hill Pasture (Edin., p. 42).

(*b*) *Nardus stricta*, with or without *Molinia varia* (Yorks., I. p. 19; West., I. p. 12; II. p. 9; Forfar, p. 16).

(*c*) *Nardus stricta* and *Juncus squarrosus*: Summit pasture (Yorks., II. p. 10; West., I. p. 17; II. p. 16; Forfar, p. 19). Upper Hill pasture (Forfar, p. 60).

(*d*) *Deschampsia flexuosa*: Forest clearings (Perth, p. 29).

(*e*) Mixtures of Grass Heath and Heather (Edin., p. 45).

Heath, or dry heather association of *Calluna Erica* and *Erica cinerea*; soil poor, with mixture of peaty humus, drainage good, and moisture not well maintained, therefore liable to drought (Edin., p. 34; Perth, p. 27).

Bracken.—Edin., pp. 41 and 48; Perth, p. 33.

(3) Substratum of continuous peat lying on a deposit of close yellowish or brownish clay or till, with or without moor-pan; moisture variable according to depth of peat and rate of drainage.

Heather Moor:

(*a*) With exclusive dominance of *Calluna*; situation on sloping ground; soil poor and covered with a felted layer of peat over till (Edin., p. 35; Perth, pp. 24 to 26; Yorks., I. p. 16; II. p. 13; West., I. p. 14; II. p. 11; Forfar, p. 59).

(*b*) With dominance of *Calluna* and *Erica Tetralix*; peat deeper and more continuously moist than (*a*), (Perth, p. 25; Yorks., I. p. 16; II. p. 10).

Molinia Grass Moor, dominance of *Molinia varia* on badly drained peat (Yorks., I. p. 18; West., I. p. 11; II. p. 10; Forfar, p. 19).

Cotton Grass Bog:

(*a*) With exclusive dominance of *Eriophorum* on deep peat; annual rainfall high, moisture excessive and drainage slow (Yorks., I. pp. 10 to 12; II. p. 9; West., I. p. 13; II. pp. 12 to 14).

(*b*) *Eriophorum*, *Calluna*, and *Erica Tetralix*: conditions almost similar to (*a*), but drainage better (Yorks., II. p. 10; West., II. pp. 12 and 14).

Myrica Bog, with dominance of Sweet Gale (Perth, p. 27).

Sphagnum Bog, with dominance of *Sphagnum* moss (West., I. p. 13; Forfar, p. 23).

Vaccinium Moor, especially in the Arctic-Alpine zone above 2000 feet, replacing Heather Moor, Cotton Grass Bog, and Grass Heath (Perth, p. 34; Forfar, pp. 61 to 64; Yorks., I. pp. 12 to 14; West., I. p. 15; II. p. 13).

(4) Wet Soils with much organic matter:

Junceta and Cariceta, with dominance of Rushes and Sedges (Yorks., II. p. 15; Forfar, pp. 119 to 121).

(5) In Water:

Vegetation of Highland Lochs and Moor Pools (Forfar, p. 82.)

C. Associations with Salt Water (Halophytic).

(1) Dry Soils:

Sand Dune Ridges.—(Edin., p. 12; Forfar, p. 69.)

Rocks and Cliffs.—(Edin., p. 13; Forfar, p. 66.)

(2) Moist Soils:

Sand Dune Hollows.—(Forfar, p. 70.)

(3) Wet Soils:

Salt Marshes.—(Edin., p. 11; Forfar, p. 73.)

Estuarine Marshes.—(Forfar, p. 74.)

(4) In Water:

Maritime Aquatic Vegetation.—(Edin., p. 11; Forfar, p. 66.)

NOTE.—In the "List of References," the editions of the *Statistical Account of Scotland,* 1796 and 1844, were omitted. Several of the parish ministers, who wrote the accounts, were good observers and botanists, hence their contributions furnish much useful information on the vegetation in earlier times; the accounts are, however, not always of equal value for all the parishes.

VIEWS ON THE UPPER NILE.

BY the courtesy of the Department for Public Works in Egypt we have been furnished with some of the blocks illustrating Sir William Garstin's *Report upon the Basin of the Upper Nile* (see also this *Magazine,* xx. p. 569), which show some characteristic views of the Bahr-el-Gebel and the Bahr-el-Ghazal. The following notes are also taken from the *Report.*

The two first figures illustrate the Fola Rapids of the Bahr-el-Gebel. The Bahr-el-Gebel, it will be recollected, flows out of Lake Albert Nyanza. The exact point of origin is more or less a matter of convention, but where a current is distinctly visible the stream has a width of 1000 metres and a depth of 4 to 6 metres. At Wadelai, 64 kilometres from the Victoria Nile, the stream narrows to a breadth of 147 metres, with a depth of 9·25 metres; but with this exception the Bahr-el-Gebel is a wide river till Nimuli (kilometre 216) is reached. Not far from this station, at kilometre 223, the Fola Rapids commence. As the illustrations show, the river here runs through high ground. Just above the rapids the width is 400 metres, the channel being broken by many papyrus-covered reefs. At the beginning of the rapids a large island divides the channel into two parts. The island is very rocky, with steep banks covered with vegetation, and is about 17 metres high by 500 metres in width. It is seen to the right of the upper figure and to the left of the lower. The main body of water runs in the eastern channel, the amount which flows in the western being insignificant except in times of flood. At the

FIG. 1.—The Bahr-el-Gebel—Fola Rapids, looking upstream.

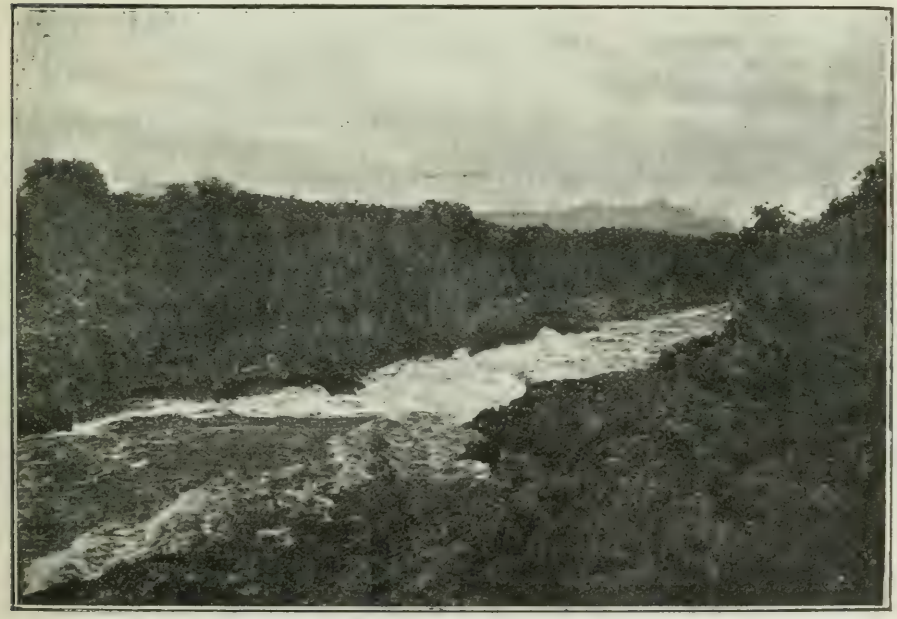


FIG. 2.—The Bahr-el-Gebel—Fola Rapids, looking downstream.

beginning of the rapids the river is contracted from 400 to 60 metres in width, and the rapids commence in two or more falls, with a drop of 5 to 6 metres. "Below the falls, the stream rushes down an extremely narrow gorge, with a very heavy slope, enclosed between vertical walls of rock. This can best be compared to a gigantic mill-race, or water-slide, 100 metres in length. The water tears through this channel in a glassy, green sheet, with incredible velocity. The width of this 'gut' is nowhere more than 16 metres across, and in places it is less! What the depth of the water may be, it is impossible to say." The lower figure shows the beginning of the rapids, and the upper part of this narrow channel. At the end of the channel, the river leaps into a deep caldron or pot, which is 50 metres long, but is only 12 metres across. Immediately below it the stream widens out to some 30 metres or more, as is shown in the upper figure, and finally thunders down, in a series of rapids, for a considerable distance. The scene is said to be one of great beauty and majesty, for vertical walls of black, polished rock, 7 to 10 metres in height, rise on either side of the water. In many places curtains of green vegetation hang down over these banks, while, as the illustrations show, the island and the river banks are covered with a dense growth of mimosa trees. "In the distance, but a long way down stream, the pointed peaks of the Kuka mountains form an effective background to this enchanting picture." The central island ends about 350 metres below the lower drop, and here the two channels of the river again unite.

Very different is the appearance presented by the Bahr-el-Zaraf, as shown in the next figure. The course of this sluggish stream may be followed on the map already published here (xx. p. 574). The principal channel by which it is fed leaves the Bahr-el-Gebel 8 kilometres downstream of Ghaba Shambé, in latitude 7° 6′ 22″ North, but there are a number of other outlets from that river into the Bahr-el-Zaraf. A large portion of its supply is derived from the drainage of the marshes which commence at Bor, and which form the eastern boundary of the Bahr-el-Gebel for a great portion of its course. The Bahr-el-Gebel pours its waters into this region by a great number of small openings in its bank, so that in flood the whole area becomes a lake, which is drained by the Bahr-el-Zaraf. Very little is known of the region traversed by the Bahr-el-Zaraf, but it is apparently a dreary swamp. To the east grass plains apparently stretch as far as the Sobat, while to the west an impassable swamp stretches in the south from the Bahr-el-Zaraf to the Bahr-el-Gebel, which is replaced to the north by bush forest. The region shown in the illustration is the southern, swamp area. The banks are very low, the average width of the stream 40 to 45 metres, and the depth 2·5 metres. Very little current is perceptible, and the river has the appearance of a sluggish drain. The river winds very much through the interminable waste of swamp which is apparently destitute both of human habitations and of game.

The remaining figures show views on the Bahr-el-Ghazal, which joins the Bahr-el-Gebel at Lake No. Both the Bahr-el-Ghazal and its tributaries are throughout their course sluggish streams, which more resemble large drainage depressions than anything else. They have a

FIG. 3.—The Bahr-el-Zaraf.

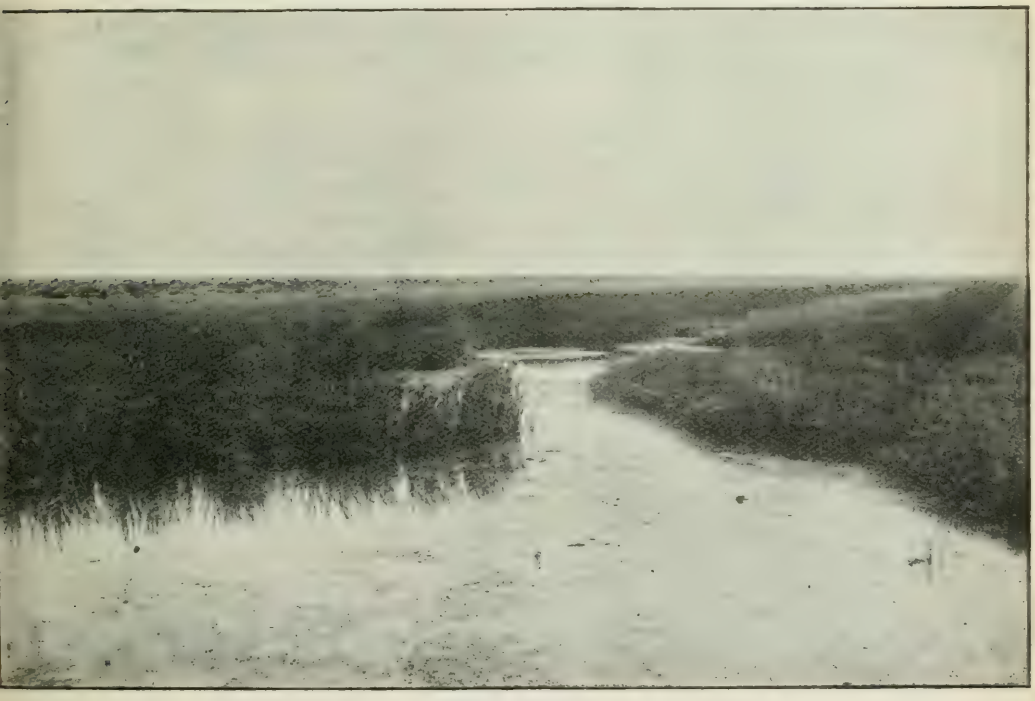


FIG. 4.—The Bahr-el-Ghazal—Mouth of the River Rohl.

very low slope, and in consequence their velocity and discharge, even in flood, are insignificant. The Bahr-el-Ghazal does not play an important part in the Nile flood; its chief function is to act as a large reservoir, which slowly drains away as the level of Lake No falls, and it is in consequence a factor of some importance in the preservation of a constant supply in the Nile during the summer months.

The first view shows the Bahr-el-Ghazal at the point where it joins with the river Rohl. This river comes from the south, and discharges into a wide expanse of channel, from 150 to 200 metres in breadth, known as the Khor Deleb. Into this wide channel the Bahr-el-Ghazal also opens, but it is here an insignificant-looking stream, only some 40 metres in width. It has, however, a decided current, while there is no apparent motion in the Khor Deleb in the summer time. The depth of the Bahr-el-Ghazal also is 4 metres, as against 2 to $2\frac{1}{2}$ in the Khor Deleb. The illustration shows the general aspect of the country in this region. The rivers are surrounded by an expanse of low marsh which is only 3·3 metres above low-water level. In flood the whole country must resemble a large lake, and the aspect at all times is desolate and monotonous to an extreme degree. There are no trees, the atmosphere is damp and warm, and even in the winter months the mosquitoes are particularly active.

As the river is ascended the country becomes more and more desolate. Beyond the border of swamp which fringes each bank of the stream there stretch away to the horizon flat grass plains, in some places covered with ant-hills, which are placed so close together that they resemble a giant graveyard. The river narrows to a breadth of about 25 metres, and twists and turns through the endless plain. The rise of water in flood does not appear to be great, probably only about 1 to 1·2 metres, but the banks are so low that even this rise must flood an enormous area of country.

At kilometre 32, reckoned from the junction with the Khor Deleb, the first papyrus, since that seen in the White Nile, is met with, and for many kilometres above this point it forms a fringe on either side of the stream. The reeds are not so high as on the Bahr-el-Gebel, nor do they grow with as much luxuriance as on that stream; the general appearance is well shown in the figure. In this region the water surface is narrow, often not more than 20 metres, but the depth averages from 5 to 6 metres. Here as elsewhere on the river ant-hills are very numerous, and reeds a great size.

As the river is ascended this papyrus belt becomes wider. At kilometre 67, the forest on the left bank comes down close to the river's edge. The ground on this bank is high in this region, and consists of a grassy plain with glades of "pine" (or juniper?) trees scattered about. On the right bank is a wide papyrus marsh, through which the river has evidently wandered at various times. This is the beginning of the reach which is occasionally blocked by sudd. Indeed, the 9 or 10 kilometres from about kilometre 67 to about kilometre 77 is always more or less dangerous at certain seasons of the year on account of probable closure by sudd. It was at kilometre 77 that Gessi Pasha was imprisoned by sudd in January 1880. His steamers were held fast for about six weeks, and

FIG. 5.—The Bahr-el-Ghazal, showing fringe of papyrus.

FIG. 6.—The Bahr-el-Ghazal—Blocked by grass sudd, 1903.

he lost 1000 men. His party was saved by the arrival of Marno in the *Bordein*, but otherwise was face to face with starvation, and it was even impossible to obtain fuel for the steamers, which were cut off from the shore by impassable swamp. In the spring of 1899 the channel was again closed near this point, while in 1903, as shown in the illustration, there was again a temporary blocking. The channel when clear has only a width of 12 metres, with a depth of $4\frac{1}{2}$ metres, and the course of the stream at all times is extremely tortuous. The effect of blocking is to give rise to a series of lagoons in the marsh, as shown in the figure. The three illustrations indeed indicate the general characteristics of the Bahr-el-Ghazal throughout its length.

THE MINERAL MATTER OF THE SEA.

By Professor R. D. Salisbury, Editor of *The Journal of Geology*.

In his article on "The Height of the Land and the Depth of the Ocean," published in this *Magazine* (vol. iv. pp. 1-41), Sir John Murray gives a series of statistics concerning the height and the cubic contents of the land, and the depth and cubic contents of the ocean. Neither this article nor any other with which the writer is familiar has discussed the amount of mineral matter which sea water contains. The purpose of this note is to direct attention to this point.

The statistics referred to above are grouped in various ways, and bring out numerous instructive facts and relations. Some of the summaries are as follows:—

TABLE I.

Cubic Contents of the Land Areas.

Continent.	Cubic Miles. (By First Estimate.)	Cubic Miles. (By Second Estimate.)	Mean Height. (By First Estimate.)
Europe,	652,750	555,610	939 feet.
Asia,	9,887,050	8,568,450	3,189 ,,
Africa,	4,246,350	3,658,800	2,021 ,,
North America,	2,725,500	2,328,550	1,888 ,,
South America,	2,699,900	2,366,500	2,078 ,,
Australia,	459,350	396,250	805 ,,
East Indies,	443,650	380,750	2,144 ,,
West Indies,	16,150	13,900	816 ,,
Madagascar,	91,950	80,150	2,199 ,,
New Zealand,	44,500	38,760	2,134 ,,
Japan,	38,000	33,010	1,420 ,,
Formosa,	9,850	8,610	2,341 ,,
Saghalien,	13,450	12,100	1,667 ,,
Greenland,	556,350	478,350	3,212 ,,
Nova Zembla,	14,400	13,650	2,130 ,,
Spitzbergen,	6,200	5,410	1,057 ,,
Iceland,	12,200	10,610	1,849 ,,
Tasmania,	5,600	4,850	1,068 ,,
	21,923,200	18,954,310	

Mean height—First estimate, 2252 feet.
Second estimate, 1947 feet.

TABLE II.

CUBIC CONTENTS OF LAND, STATED IN TERMS OF ALTITUDE.

Height in Feet.	Cubic Miles. (By First Estimate.)	Cubic Miles. (By Second Estimate.)	Percentage. (By First Estimate.)
0 to 600	4,801,000	4,634,200	21·900
600 to 1,500	4,742,250	4,417,650	21·631
1,500 to 3,000	4,679,550	4,211,650	21·345
3,000 to 6,000	4,277,050	3,338,150	19·509
6,000 to 12,000	2,705,300	1,974,410	12·340
12,000 to 18,000	646,350	350,600	2·948
18,000 to 24,000	69,200	21,000	0·316
Over 24,000	2,450	650	0·011
	21,923,150	18,948,310[1]	100·000
Antarctic Continent,[2] . .	1,520,700	1,314,750	
	23,443,850	20,263,060	

TABLE III.

AREAS OF THE OCEAN'S FLOOR AT DIFFERENT LEVELS.

Fathoms.	Total Square Miles.	Percentages.
Between 0 and 100	10,135,250	7·387
,, 100 and 500	7,380,550	5·379
,, 500 and 1,000	6,475,200	4·719
,, 1,000 and 2,000	29,211,200	21·292
,, 2,000 and 3,000	77,661,650	56·605
,, 3,000 and 4,000	6,190,400	4·512
Over . . 4,000	145,200	0·106
Total, . .	137,199,450	100·000

The percentage of mineral matter in the sea water is usually given at 3·5 per cent. by weight. Assuming its average specific gravity to be 2·5, the 3·5 per cent. by weight becomes 1·4 per cent. by volume. The volume of the sea is estimated by Murray to be 323,722,150 cubic miles,[3] and 1·4 per. cent. of this volume is 4,532,110 cubic miles. This then represents the aggregate volume of mineral matter in the sea if it were precipitated and compacted so as to have an average specific gravity of 2·5. Of this, nearly 78 per cent. by weight is common salt. Assuming the average depth of the sea to be 2076 fathoms (12,456 ft.), as given by Murray,[4] the mineral matter in solution, if precipitated, would cover the ocean bottom to a depth of about 175 feet. Assuming the average depth of the ocean to be 11,500 feet, as given by Murray and Mill,[5] the thickness of the layer would be 161

[1] This figure is given as 18,954,310 in the original table, an error in addition. The figure should, of course, correspond with that of the second column of Table II.

[2] These figures are obtained from the estimated area of the Antarctic Continent and the estimated mean height of the globe; but the Antarctic land is probably higher from the accumulation of snow and ice.

[3] *Op. cit.* p. 39. [4] *Idem.* p. 40. [5] *International Geography*, p. 47.

feet. Other current figures concerning the depth of the ocean give intermediate results.

Assuming the area of the land to be to that of the sea as 28 : 72, the mineral matter of the sea would make a layer about 450 feet thick over the land on the first of the above assumptions, and about 414 feet on the second. It would make a layer about 125 feet thick over the whole earth.

Again, assuming the cubic contents of all the land to be 23,443,850 cubic miles (Table II. above), the mineral matter in solution in the sea, 4,532,110 cubic miles, is equal to nearly one-fifth (19·3 per cent.) of that of the land. Comparing the figures in another way, the mineral matter of the sea is about equal in amount to all of North America (including Newfoundland, the Aleutian Islands, and the Arctic islands except Greenland), Europe (including Great Britain, the Mediterranean and Baltic islands), Australia, the East Indies, the West Indies, Madagascar, New Zealand, Japan, Formosa, Saghalien, Spitzbergen, Iceland, and Tasmania: that is, the amount of mineral matter in solution in the sea water is about equal to the mass of all lands, except Asia, Africa, South America, Antarctica and Greenland[1] (Table I.)

Comparing the amount of mineral matter in solution in the sea with the figures in Table II., it is found that the former falls but little short of that in all lands below 600 feet, or of that in all lands between the altitudes of 600 and 1500 feet, or between 1500 and 3000 feet.

Assuming the average depth of those parts of the sea where the water has a depth of between 0 and 100 fathoms to be 50 fathoms, and the average depth of those parts where the depth of water is between 100 and 500 fathoms to be 300 fathoms, the cubic contents of that part of the sea which has a depth of less than 500 fathoms is about 3,092,000 cubic miles. Assuming the area where the sea water has a depth of between 500 fathoms and $666\frac{2}{3}$ fathoms (4000 feet) to be one-third the area where the depth of the water is between 500 fathoms and 1000 fathoms, and that the average depth of water for the area where the depth is between 500 fathoms and $666\frac{2}{3}$ fathoms is $583\frac{1}{3}$ fathoms (3500 feet), the cubic contents of that part of the sea which lies between these depths is about 1,430,757 cubic miles. This figure, added to the 3,091,965 above, gives about 4,523,000 cubic miles as the approximate volume of the sea, for the area where the depth of the water is less than 4000 feet. This volume is nearly the same as the aggregate volume of mineral matter in the sea water. If these figures are correct, it follows that if the mineral matter of the sea were all precipitated and concentrated about the borders of the land, it would be sufficient to fill the ocean basins up to the present sea-level from the present land borders out to a depth of about 4000 feet: that is, over an area of between 19,000,000 and 20,000,000 square miles. Making allowance for the rise of water which would result from the contraction of the basin if this amount of mineral matter were precipitated in it, the area of land would be increased about 19,000,000 square miles, if all the mineral matter

[1] The area of Greenland, as given by Murray (914,000 square miles), is greatly in excess of the area generally given.

in solution in the sea were precipitated and concentrated about the shores of the lands, filling the ocean basins to the level of the water out to a uniform depth of about 4000 feet. This area, 19,000,000 square miles, is equal to more than one-third the area of all existing land. It is an area nearly equal to that of Asia and Australia: an area nearly equal to North America, South America, Europe, and the East Indies; or to Africa, Europe, Australia, and all islands except the East Indies.

These figures may perhaps give some idea of the amount of mineral matter in solution in the sea, but they give no more than a hint of the importance of the solvent work of water, for most of the substances carried to the sea in solution by rivers are extracted from the water about as rapidly as they are supplied. It is probable, indeed, that the amount of mineral matter which has been extracted from the sea water far exceeds all that remains in solution. This conclusion may be reached either (1) by calculating the volume of rock which has been extracted from the sea water, or (2) by comparing the proportions of the various sorts of mineral matter in sea and in river water.

(1) The rock matter extracted from the sea includes most of the limestone, the gypsum, and the salt, and probably much of the cementing material of all other sorts of sedimentary rocks. Data concerning the thickness of such materials beneath the sea are not available, but their average thickness, for land areas, most of which have been beneath the sea at times, probably far exceeds 250 feet or even 450 feet. Dana suggests that the average thickness of limestone may be 1000 feet.[1] (This figure may have been meant to include dolomite, though it is not so specified.) This figure appears to take no account of the calcium carbonate which forms an important constituent of many shales and some sandstones. Furthermore, much material, such as that of limestone, has been extracted from the sea water and deposited, and then re-dissolved, re-extracted, and re-deposited. Some material, indeed, has probably gone through this cycle repeatedly. Furthermore, these considerations take no account of the deposition of material from solution on the surface of the land, or beneath it, or beneath the surface of the lithosphere under the sea, and these are important parts of the work of ground water.

TABLE IV.

Amount of Mineral Matter in Solution in One Cubic Mile of Sea Water.[2]

Constituents.	Tons.
Chloride of sodium ($NaCl$),	117,434,000
Chloride of magnesium ($MgCl_2$),	16,428,000
Sulphate of magnesium ($MgSO_4$),	7,154,000
Sulphate of calcium ($CaSO_4$)	5,437,000
Sulphate of potassium (K_2SO_4),	3,723,000
Bromide of magnesium ($MgBr_2$),	328,000
Carbonate of calcium ($CaCO_3$),	521,000
For sea water, total dissolved matter,	151,025,000

[1] Dana, *Manual of Geology*, 4th ed., p. 485.

[2] Based on Dittmar's Table, *Challenger Reports*, Physics and Chemistry, vol. i. p. 204.

TABLE V.

Mineral Matter in Solution in One Cubic Mile of Average River Water.[1]

Constituents.	Tons.
Calcium carbonate ($CaCO_3$),	326,710
Magnesium carbonate ($MgCO_3$),	112,870
Calcium phosphate ($Ca_3P_2O_8$),	2,913
Calcium sulphate ($CaSO_4$),	34,361
Sodium sulphate (Na_2SO_4),	31,805
Potassium sulphate (K_2SO_4),	20,358
Sodium nitrate ($NaNO_3$),	26,800
Sodium chloride (NaCl),	16,657
Lithium chloride (LiCl),	2,462
Ammonium chloride (NH_4Cl),	1,030
Silica (SiO_2),	74,577
Ferric oxide (Fe_2O_3),	13,006
Alumina (Al_2O_3),	14,315
Manganese oxide (Mn_2O_3),	5,703
Organic matter,	79,020
Total dissolved matter,	762,587

(2) By comparing the mineral matter in the sea water with that in average river water (Tables IV. and V.), it is found that calcium carbonate is about twenty times as abundant as sodium chloride in river water, but only $\frac{1}{2\frac{1}{2}\frac{1}{5}}$ as abundant in sea water. If the calcium carbonate which has been taken to the sea in solution by rivers had remained in solution as calcium carbonate in the same proportion that the sodium chloride has remained in the sea water, the figures representing the amount of common salt which the sea contains would seem almost insignificant in comparison. Even if calcium carbonate is changed to calcium sulphate in the sea, as is sometimes thought, the case is not seriously altered, for the amount of calcium sulphate in the sea is but a small fraction of the amount of sodium chloride. In order that the sodium chloride should have attained such predominance, it is necessary to suppose that enormous quantities of the compounds of calcium have been extracted, if the salt of the sea has been derived from the land.

Similarly, the average river water contains about seven times as much magnesium carbonate as sodium chloride, four and a half times as much silica, twice as much calcium sulphate, twice as much sodium sulphate, more potassium sulphate, and more sodium nitrate; yet the combined volume of all these substances in the sea water is but a small fraction of the amount of sodium chloride.

By either of these lines (1) and (2) of approach, we reach the conclusion that the amount of mineral matter which the sea has lost from solution far exceeds that which it has held.

[1] Russell's *Rivers of North America.*

THE DEVELOPMENT OF RHODESIA AND ITS RAILWAY SYSTEM IN RELATION TO OCEANIC HIGHWAYS.

By J. T. P. Heatley.

(With Maps and Illustrations.)

In a former paper on "The Port of the Upper Nile in relation to the Highways of Foreign Trade" (*S.G.M.*, xi. p. 571), it was my aim to discuss the lines of communication leading to the Upper Nile from Alexandria, Suakin, Massaua, Berbera, Mombasa and Chinde, and to determine the economic zones that might be commanded by the highways of trade from these several ports. It is my aim in this paper to give an account of the economic development of Rhodesia, and to discuss its railway system in relation to the oceanic highways.

Rhodesia comprises those territories the development of which is directed by the British South Africa Company. It is well named, for it was owing to the energy, enterprise, and sagacity of Mr. Rhodes that the colony was founded and now forms part of the British Empire. "To see all that British is my dream!" Mr. Rhodes is said to have exclaimed when referring to the possible acquisition of these vast territories. As originally defined in the Charter of Incorporation, the extent of territory open to occupation by the South Africa Company was "the region of South Africa lying immediately to the north of British Bechuanaland, and to the north and west of the South African Republic, and to the west of the Portuguese dominions." Its sphere is now bounded by the Transvaal Colony, Portuguese East Africa, the British Central Africa Protectorate, German East Africa, the Congo Free State, Angola, German South-West Africa, and the Bechuanaland Protectorate. It is divided into two parts by the Zambezi—Northern Rhodesia and Southern Rhodesia; and each of these again is subdivided into two provinces: Southern Rhodesia into Matabeleland and Mashonaland; Northern Rhodesia into North-Western Rhodesia and North-Eastern Rhodesia.

Africa is a continent of tablelands; and Rhodesia, physically viewed, consists chiefly of a vast elevated tableland, the general altitude of which varies from 3000 to 5000 feet. One or two points may be chosen to indicate relative heights. The Zambezi at the confluence of the Luangwa River is 780 feet above sea-level, and at the Victoria Falls it is 2850 feet; Lake Tanganyika is 2680 feet; the altitude of Salisbury is 4800 feet, and Marandellas, which is 5600 feet above sea-level, and 45 miles from Salisbury, is the highest point on the railway between Salisbury and the coast; Bulawayo is 4250 feet; Fort Jameson 3600 feet; Fife 5400 feet. Rhodesia belongs to several hydrographic systems —the Zambezi, the Congo, the Sabi, and the Limpopo.

Although the whole of Rhodesia falls within the Tropics its climate is modified by its altitude, and as a very considerable part of it is above 3000 feet, it may thereby be regarded as a white man's country,

and well fitted not only for British residence but for British colonisation. It has been estimated that in Southern Rhodesia alone there are 100,000 square miles above 3000 feet with a suitable climate for Europeans, and 26,000 square miles above 4000 feet where the average temperature allows European children to be born and bred. The year is divided into two parts according to the rainfall—a wet and a dry season. The wet season begins about the end of October and terminates about the end of April. From May to September there is little or no rain, and this period—the Rhodesian dry season—is the best time to arrive.

The economic possibilities of Rhodesia are manifold and immense. To develop this potential wealth has been the aim of the British South Africa Company. When the Company was formed the chief and virtually prescribed objects of its administration were to extend northwards the railway and telegraphic systems of the Cape Colony and Bechuanaland; to encourage immigration and colonisation; to promote trade and commerce; to develop and work mineral and other concessions.

The fame of gold and other mineral wealth has been associated with this part of Africa since the most ancient times. Many old workings have been found, and these have facilitated modern prospecting. In Southern Rhodesia gold-fields have been discovered both in Matabeleland and Mashonaland,—chiefly in the Bulawayo, Gwelo, Salisbury, Umtali, and Mazoe districts. The development of the gold-fields has been frequently interrupted, but considerable advance has been made, as may be seen from the progressive output: in 1898 the output amounted to 16,706 ozs.; in 1899, 56,742 ozs.: in 1900, 85,366 ozs.; in 1901, 172,035 ozs.; in 1902, 194,170 ozs.; and in 1903, 231,872 ozs. Copper has been discovered in both Northern and Southern Rhodesia. In Southern Rhodesia it is found in Victoria, Melsetter, Lo Mogundi, and Mafungabusi districts; in Northern Rhodesia on the Kafue river and on the borders of the Congo Free State. The principal lodes, so far opened up, are on the Kafue river and in the Lo Mogundi district. The deposits in Northern Rhodesia give every promise of a great mineralised field which is being systematically developed. Several coal-fields have also been discovered. Chief among them is the vast coal-field of Wanki, which promises to be one of the most important discoveries in Rhodesia. The coal is considered to be second only to the best Welsh. Other minerals found, in varying quantities, are silver, blende, antimony, arsenic, lead, and iron.

Although gold and other mineral wealth promote the speedy development of new territories, the permanent prosperity of such a country as Rhodesia must ultimately depend upon its pastoral and agricultural resources. "Owing to its fertile soil," says Mr. Ross Townsend, Secretary for Agriculture in the Rhodesia Administration, "regular wet season, ample rainfall, genial climate, and cheap land, Rhodesia offers prospects for successful farming operations second to none in South Africa, and comparing favourably with most British colonies. The fertility and variety of soils are capable of producing most kinds of cereals, tobacco, vegetables, and fruit, where energy and enterprise are brought to bear on it, as has been practically demonstrated in the different districts of

the country." It is worthy of note that, owing to the geological formation of the country, the best arable land is usually situated within a reasonable distance of the gold reefs: there is always a great demand for agricultural produce, at remunerative prices, at Bulawayo, Salisbury, and Selukwe. It is estimated that in Matabeleland alone there are 50,000 square miles available for pasture and arable land, and of this about 6000 square miles are suitable, without much preliminary work, for European cultivation. The size of farms in Mashonaland is generally about 1500 morgen (approximately 3000 acres); Matabeleland farms are about twice the size. Rhodesia offers attractive prospects to the man of energy and enterprise who has a knowledge of agriculture, and a capital of £500 to £1000. Mealies—maize or Indian corn—is the staple cereal product, and can be made to produce as heavy a yield as in any other part of the world. The demand is practically unlimited, not only for local markets but throughout South Africa. Wheat grows well and yields abundantly in many parts of the country. Samples of Rhodesian wheat have been well received on the British corn market. Root crops of all kinds do remarkably well and yield heavily, especially potatoes. Cattle generally do well everywhere; sheep and goats—Cape Boer goats, Persian sheep, and the Cape fat-tailed sheep—thrive well all over Rhodesia, and the increase is rapid. The merino sheep is found to do well in the eastern highlands, where a million sheep could be grazed without overstocking. The prevalence of horse-sickness has hitherto prevented the breeding of horses and mules; but Dr. Koch is convinced that a simple process for immunisation is possible much on the lines of his process for inoculation against rinderpest, by which means South Africa has been rid of that disease. If this system of inoculation succeeds, as is anticipated, then there will be a great future for horse and mule breeding in Rhodesia, not only in meeting local requirements, but in supplying remounts for the British Army.

Of tropical and sub-tropical products the most important for Rhodesia are rubber, tobacco, and cotton. Rubber is found in abundance in the Sabi Valley, along the Zambezi, and in many parts of Northern Rhodesia. Mr. Lyttelton Gell has discussed the future development of this industry, and has advocated the systematic cultivation of rubber. Tobacco grows well everywhere, and in the opinion of an American expert there is a great field for enterprise, as the different varieties of soil are capable of growing the light cigarette tobacco, the cigar leaf, and heavy smoking tobacco. A special report on tobacco culture has been prepared by Mr. G. M. Odlum, of the Department of Agriculture of Southern Rhodesia, in which he shows from an investigation of the industry in America, and from analogy, that the growing of tobacco will play an important part in agricultural development.

Another promising industry is the growing of cotton. Samples both of native wild cotton and of that grown from Egyptian seed have been favourably reported on, both by the British Cotton-growing Association and by the Director of the Imperial Institute, London. "I have examined," says Mr. Wolstenholme, in his report (January 7, 1904) on behalf of the above mentioned association, "the samples of cotton grown

in Rhodesia now on view at the Liverpool Exhibition. At the present moment they are worth considerably more than the prices affixed to them, these, I think, being the figures I placed on them some months since. The Egyptian seed lots are worth 8½d., and the native seed 8½d. to 9d. I feel sure that if you can keep up the standard of these samples there is a large fortune in the business. Your Egyptian samples are much superior to the Nyasaland cotton sold at 7½d. per lb. Planters from the Zambezi inform me that they could obtain plenty of labour, as the natives from Portuguese East Africa prefer to work cotton to working in Rhodesian mines. It is evidently one of the few countries where the product of the Egyptian seed maintains its characteristics, Peru being the only other I know, though it has been tried everywhere. If you have sufficient land and labour available to produce quantity equal to the samples, you probably have more valuable gold mines above than below ground in Rhodesia." If Rhodesia develops her cotton belt, it will be not the least of her services in contributing to the economic prosperity of the United Kingdom and the Empire.

Rhodesia is an inland country. This fact has an important bearing on its economic development. The vital problem here, as in several other parts of Africa, has been the inland carrying trade. Since such an important river as the Zambezi flows through Rhodesia, it might well be assumed that it would afford an easy line of access, and that its waterway would become a great artery of commerce. But on account of the configuration of the African Continent the navigation of the Zambezi is interrupted by falls and rapids at several points where the river descends from the tablelands of the interior. It is a river subject to great fluctuations of depth: during the wet season it floods and rises as much as 15 to 20 feet; at the height of the dry season it is reduced to shallow and uncertain channels which vessels with merely a draught of 18 inches would find hardly navigable. The former difficulties at the delta have been removed since 1889, when the navigable Chinde mouth was discovered, and the port of Chinde is now the chief *entrepôt* for the several fields of trade commanded by the Zambezi highway.

The Zambezi may be physically divided into three sections: the lower river extending from the sea to the Kebrabasa Rapids—a distance of about 400 miles; the middle, from Kebrabasa to the Victoria Falls —a further distance of 900 miles; and the upper from the Falls to the source of the river, six or seven hundred miles. The lower section up to Tete is navigable for stern-wheel and other small draught steamers for eight or nine months in the year. During the other months the shallows near Sena, where the river widens to a breadth of about two miles, make navigation difficult. From Tete goods are taken overland to Cachomba—a distance of over 130 miles—in order to avoid the rapids. At Chicoa or at Cachomba, above the Kebrabasa, navigation again becomes possible to and beyond Zumbo, where the river is again obstructed at the Kariba Gorge. At present goods are forwarded from Cachomba either by carriers or by water to Zumbo and Feira, and are distributed from these points. In order to facilitate the transit of goods to the west, it is proposed to construct a wagon road round the

Kebrabasa rapids, and ultimately a light railway. From Chinde the rates are £5 per ton to Tete, £10 for each passenger; to Feira £25 and £30 respectively. Several of the transport companies are devoting their energy and enterprise to developing this highway of trade and the waterway of the Upper Zambezi.[1]

In January 1901, at a meeting of the Royal Colonial Institute, Major Gibbons discussed the Zambezi system as a waterway, and sug-

FIG. 1.—View of the Gorge, Victoria Falls.

gested schemes by which it might be developed into a great commercial highway. "I look forward," he said, "to the day when a boat will travel those 1200 miles from Chinde to Molele without the necessity of transhipping." That is a long view; but it indicates the direction in which development is proceeding apace. At several points along the main river the transit trade is rapidly increasing. Thus Tete has be-

[1] See Foreign Office Reports on the Trade of Chinde for the years 1902, 1903, 1904; and Foreign Office Reports on the Trade of Tete and District for the year 1901 (Annual Series, 2812) and 1903 (Annual Series, 3210).

come a convenient depôt for the transit of goods and an important point on the lines of communication to North, South, and West. Through Tete the telegraph system passes from Rhodesia to British Central Africa, and from the East Coast to Zumbo. A postal service has been established by a weekly overland mail between Tete and Salisbury; and a commercial route will probably be developed up the Mazoe Valley with Southern Rhodesia. Another route of increasing importance is that from Tete to Fort Jameson and other parts of North-Eastern Rhodesia. Goods are shipped to Tete from Chinde and thence forwarded to Fort Jameson by carriers. The rates of freight from Tete to Fort Jameson are 8s. to 10s. a load of 50 to 60 lbs. A road is at present under construction between these two places to facilitate communications. From Chinde to Fort Jameson the rates for goods by way of Tete are £25 a ton; for passengers £28.

The Zambezi system comprises that of the Shire river and Lake Nyasa, and this is the best route to the northern and eastern districts of North-Eastern Rhodesia. This Nyasaland route follows the Zambezi and Shire waterways to Lake Nyasa. At Chiromo, or Katunga, 60 miles higher up the river, navigation ceases, and goods are carried overland through Blantyre to the Upper Shire. Stern-wheelers provide transport as far as Fort Johnston at the south end of Lake Nyasa. From this point steamers ply to the several ports on the Lake. The ports for North-Eastern Rhodesia are Domira Bay and Kota-Kota for Fort Jameson, and Karonga, on the northern shore, for Fife and Abercorn and the districts bordering on Lake Tanganyika. The rates of freight by Lake Nyasa from Chinde are per ton to Fort Jameson £28; to Karonga £20; to Fife £35; to Abercorn £50, and Mweru £75. The passenger rates to the same points are £35; £30; £41, 5s.; £52, 10s.; and £75. A railway is now being constructed from Chiromo to Blantyre, and thence to Lake Nyasa. When completed it will form an important link in this system of communications and greatly promote the increasing success of this commercial highway to the heart of Africa.

The Zambezi, however, has hitherto played but a subordinate part in the opening up of Rhodesia to commerce and civilisation. It was from the Cape that British enterprise developed communications with the northern territories in the basin of the Zambezi.

One of Mr. Rhodes's earliest efforts was to get the Cape Parliament to extend the Cape Government Railway to Kimberley. This was allowed, notwithstanding considerable opposition. Afterwards the Afrikander Bond determined that Kimberley should remain the terminus of this railway, and that any further extension should be from the Cape to Bloemfontein and Johannesburg. That this would give control of the trade of the interior into the hands of the two Boer States, and so be a menace to British interests, was only too evident. The true route to the north was, according to Mr. Rhodes, through Bechuanaland. When the British South Africa Company took over the administration of the country, Kimberley was the nearest centre of communication. After the Charter was signed, permission was obtained to extend the Cape Government Railway from Kimberley to Vryburg.

This extension of 126 miles was begun in November 1889, and finished in December 1890, the work having been completed in little over a year. Want of funds, however, put a stop to further extension for some time; but in May 1893 the Bechuanaland Railway Company was incorporated to continue the line northwards from Vryburg to Bulawayo *viâ* Mafeking, Palapye (Palachwe), and Francistown. This, a distance of 587 miles, was completed in October 1897. During the construction of this

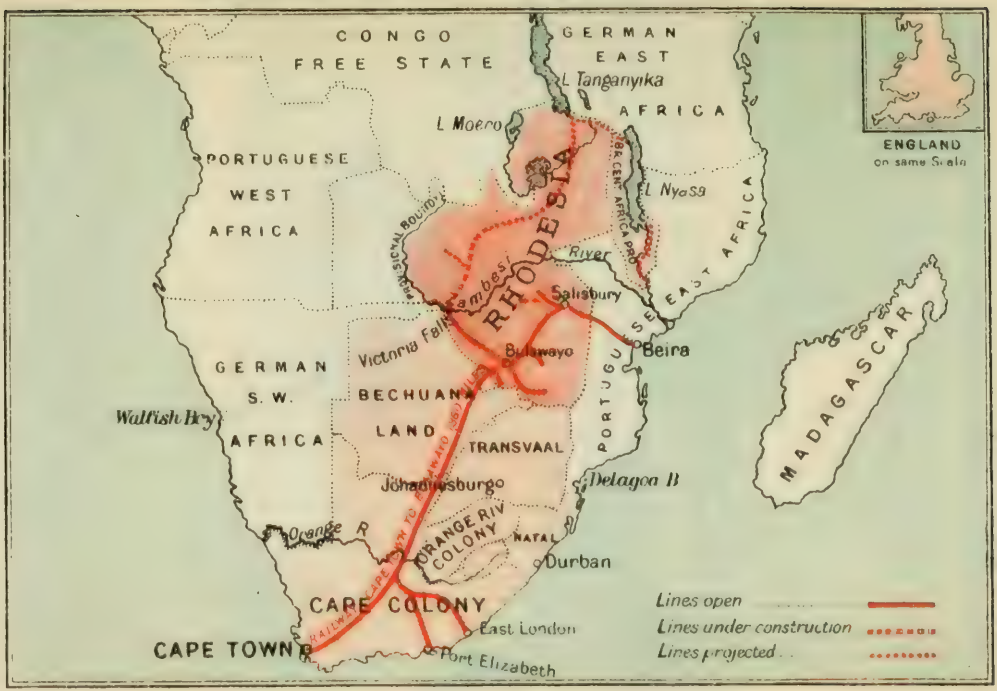
FIG. 2.—Conical Tower, Zimbabwe Ruins (see page 152).

line the great rinderpest scourge swept over the country, practically killing the whole of the trek-oxen. It was estimated that, before the outbreak in 1896, there were over 100,000 cattle in Matabeleland, and by the end of the year there were only about 500 left. The difficulty of transport thus brought about, and the outbreak of the Matabele War, impelled the Company to push on the work by what may be termed forced marches, so that, in most striking contrast with the earlier construction, the last 228 miles from Palapye to Bulawayo were completed in the very short space of four and a half months. The line was

formally opened on the 4th November 1897. With the establishment of this direct communication of Bulawayo with Cape Town—a distance of 1360 miles—was inaugurated a new era in the history of Matabeleland and Rhodesia.

But Mashonaland was the first Rhodesian territory, and communication with the East Coast was desiderated. While the Bechuanaland Railway Company, now known as the Rhodesian Railways, Limited, was constructing this line to Bulawayo, a line was being projected from Salisbury to Umtali, and thence to the Portuguese port of Beira. The distance between Salisbury and Beira is about 375 miles; but although the distance was not great, there were considerable difficulties to be overcome. The Anglo-Portuguese treaty of 1891 had a clause which provided for the construction of a line of railway from the Pungwe river to Salisbury *viâ* Manicaland, but political causes were responsible for much delay. Another serious obstacle in constructing the line was the hilly nature of the country. From sea-level at Beira the country gradually rises: an altitude of 5600 feet is attained at Marandellas, 45 miles from Salisbury, which is the highest point on the Salisbury-Beira line. From Marandellas there is a gradual descent into Salisbury, which is 4800 feet above sea-level. The chosen starting-point of this line was Frontesvilla, 35 miles up the Pungwe river, from which place the line, 2-feet gauge, was laid in a westerly direction for a distance of 75 miles. This section was opened in October 1893. Considerable delay was occasioned in the construction of this first section, which runs through the Pungwe Flats, by the frequent "washaways" which occurred during the wet season. There were other difficulties also on account of the swampy nature of the country; yet the work went on surely, and in November 1894 the rail was carried on as far as Chimoio—a distance of 118 miles from Fontesvilla. This point remained a terminus for some years. It was not until October 1896 that a line was constructed between Beira and Fontesvilla. Thus there was a 2-feet gauge line for a distance of 153 miles. Great difficulties were, however, experienced in continuing the line from Chimoio to Umtali on the Portuguese border, and it was not until February 1898 that the 2-feet gauge line to the border was completed. In 1897 the Mashonaland Railway Company was formed to carry out the construction of a 3-feet-6 gauge line from Umtali to Salisbury. The work was begun on 11th January 1898, and the line was completed in May 1899, on which date Salisbury was in direct railway communication with Beira. As the line from Beira to Umtali was only of a 2-feet gauge, considerable expense and delay were incurred in transferring goods from the narrow gauge to the broad gauge line, and as it was also found that the 2-feet gauge line could not cope with the necessary amount of traffic, it was decided to widen it to the standard gauge of 3 feet 6. Before this work was entered upon, the line between Beira and Umtali was partly re-surveyed, some of the worst gradients were thus avoided, and a saving of 18 miles was effected. The broad gauge line from Beira to Umtali was completed in August 1900. Since 1900 vast improvements have been effected on this line: in former years "washaways" were frequent and dangerous, but the addition of numerous

RAILWAY MAP OF SOUTH AFRICA IN 1904.



culverts has done much to lessen the constantly recurring damage caused by the rains to the permanent way.[1] The great need of Mashonaland had been, from the outset, a rapid and cheap system of communication with the coast. Mr. Rhodes hoped by a railway from Beira to Salisbury to reduce the cost of importing food-stuffs into the country from £70 to £10 a ton. The completion of this railway system was therefore a great boon to all concerned in the economic development of the eastern districts of Rhodesia.

The next phase in the development of the Rhodesian railway system was the linking up of Bulawayo with Salisbury. In 1898 Mr. Rhodes

Fig. 3.—Umfuli River, crossed by the Railway from Gwelo to Salisbury.

contemplated the extension of the main trunk line from Bulawayo *viâ* Gwelo and the Zambezi to Lake Tanganyika as part of his great Cape to Cairo scheme. After an unsuccessful attempt to obtain the co-operation of the Imperial Government in this undertaking, the various mining and exploration companies were approached, and sufficient funds were raised for the construction of the first section of 150 miles. It was also decided, whilst the railway was being pushed northwards *viâ* Gwelo, to construct a line from Salisbury to meet the northern extension. The line from Bulawayo to Gwelo was begun in May 1899,

[1] *Vide* Foreign Office Report on the Trade of Beira for 1902 (Annual Series, No. 3024), p. 7.

but its continuation was interrupted by the Transvaal War. Although the northward extension was thus stopped, the vigilant and vigorous directors of the Rhodesian Railways, Limited, decided to extend the line from Salisbury towards Bulawayo, and by the 1st January 1902 the 188 miles from Salisbury to Gwelo were completed and open to the public. After peace had been proclaimed, and the line from Cape Town could be used for transport of railway material, the construction of the line from the Bulawayo end was proceeded with, and on 1st December 1901, six months after the Salisbury extension had reached Gwelo, Cape Town and Beira were in railway communication. Thus the Rhodesian railway system became a connecting link in a through system of South African communication from coast to coast.

This Rhodesian highway may be regarded as the vertebral system of the colony. In an old and settled country the general direction of a railway system is mainly determined by the recognised importance of the towns and localities which it connects. But in opening up new territories, while the topography must needs have a determining influence, the problem is one also of the potential: the call is for prevision—for a prudent anticipation of industrial centres and of the general growth of the community.

These conditions have been well satisfied in the route chosen. The alignment of the Rhodesian system follows the trend of the healthy uplands where the British-born may settle and form permanent homes. Already several thriving townships are found along the route of the main railway. The effect of rapid and cheap communication soon became manifest in the noteworthy development of Bulawayo. The line from the Cape reached Bulawayo some eighteen months before Salisbury was connected with the coast. Although the township of Bulawayo was three years younger than Salisbury, it soon exceeded the latter in population and in the number and size of its buildings; the streets are well laid out, and the buildings are both handsome and costly. Government House, built originally as a private house by Mr. Rhodes after the style of Groote-Schuur on the slopes of Table Mountain, is on the site of Lo Bengula's old kraal. An extensively laid-out park connects it with the town, and its avenue, which has been planted throughout its entire length, promises to become a rival to the great avenue at Cape Town. Salisbury, which is the seat of government, has likewise some good buildings and a well laid-out park. On the railway between Bulawayo and Salisbury are the rising townships of Gwelo and Hartley. The former is the centre of the best gold-producing country; the latter, which is 111 miles from Gwelo and 77 miles from Salisbury, has many gold-mines in its vicinity. Other townships in Southern Rhodesia are Victoria, Umtali, Enkledoorn, Melsetter, Rusapi, Selukwe, Gwanda, and Tuli. Bulawayo and Salisbury have been constituted municipalities; the smaller towns are controlled by local Sanitary Boards.

Granite has hitherto been utilised only in building bridges and laying foundations, owing to the heavy working expenses entailed. It is found, however, in large quantities throughout Rhodesia, and merely awaits the advent of hands and head.

The economic development of Rhodesia has necessitated the building of branch lines to several mining districts. From Bulawayo a line has been laid down to the Gwanda district, which is rich in gold and coal fields. The work, which was begun in 1899, was stopped on the outbreak of the war. By March 1904, 91 miles had been completed, and since that time there has been an addition of 13 miles, which makes this important branch line 104 miles in length. The interests of Selukwe, which is fast becoming the centre of a large gold-mining district, have also been advanced by connecting it with Gwelo. This line, which is 24 miles long, was completed in 1903. It is also intended to construct a line from Salisbury to the Mazoe Valley, another mining district. The survey has been completed, and the line will be about 26 miles long. By August 1902 a 2-feet gauge line was laid down from Salisbury as far as the Ayrshire gold mine. This line is the property of the Ayrshire and Lo Mogundi Railway Company; 84 miles have already been constructed, and it is contemplated to carry it on for 30 miles more to the Alaska mine. Another branch is under consideration from Umtali northward to Penhalonga.

As an indication of local developments in the winning of gold, the following statistics are derived from the Report of the Secretary for Mines, Southern Rhodesia, for the year ending 31st March 1904. The tons crushed amounted to 516,747; producing by milling, 198,477 ozs.; giving an average of 7·6 dwts. per ton. In addition to the gold obtained by milling, 29,272 ozs. were recovered by cyanide treatment; 5511 ozs. from concentrates; and 1431 ozs. from various pannings. The grand total for the year amounted to 234,693 ozs. The production according to districts was as follows:—62,447 ozs. in the Bulawayo district; 136,292 ozs. in the Gwelo district; 1604 ozs. in the Salisbury district; 26,907 ozs. in the Umtali district; 7160 ozs. in the Hartley district; 38 ozs. in the Lo Mogundi district; 242 ozs. in the Victoria district.

Gold-mining, however, has not been the only mining industry which has contributed to the development of the Rhodesian railway system. In order to tap the northern parts of Rhodesia, it was originally intended that the line from Bulawayo should branch off at Gwelo and thence proceed through the Mafungabusi district to cross the Zambezi at the Kariba Gorge, through North-Western and North-Eastern Rhodesia to Lake Tanganyika. This route, however, was found impracticable, as the country north of the Kariba Gorge was in no way adapted to railway construction. In view of the difficulties to be encountered from Gwelo, and on account of the important discovery of a large coal area (600 sq. miles) at Wanki, it was decided to carry the line from Bulawayo in a more westerly direction than was originally intended, through the vast timber forest of the Gwaai river district, and on to the Falls through the great Wanki coalfield, thence on to Lake Tanganyika. The work of laying the line was commenced in May 1901, and in September 1903 the rail reached Wanki, a distance of 200 miles from Bulawayo. On the route to Wanki the line runs parallel with the Khami river, and after crossing the Insese and Umguza rivers it enters the extensive Gwaai forest. The Gwaai river is crossed at a spot about 90 miles from

Bulawayo, at which point the altitude is 3240 ft., or about 1200 ft. lower than that of Bulawayo. The line then leaves the Gwaai, and after passing through a large expanse of sandy plains, it comes to Wanki. From Wanki to Victoria Falls is a distance of 75 miles, and over this part of the country, which is of a more hilly nature, the line was carried and completed on 25th April 1904. The bridging of the Zambezi has been a considerable engineering feat. It is expected that the construc-

FIG. 4.—The Western Cataract, or Leaping Water, Victoria Falls.

tion of the bridge will be completed in June of this year. The extension of the railway north of the Falls has been authorised as far as Kalomo, 100 miles beyond the Falls, the capital of North-Western Rhodesia. In order that the construction of this part of the line may not be delayed, the material is being conveyed across the Zambezi by means of an aerial cableway. At the present time (February 1905) the earthworks on the north side of the Zambezi are completed for the first 29 miles, and the rails are laid for 12 miles. From Kalomo the railway will be continued north-westward to the Kafue river. Beyond the river it will bifurcate,

one line proceeding north-westward to develop the great mineral field of the Hook of the Kafue, from which point it may ultimately be continued to the great copper-field of Kansanshi, on the border of the Congo State. The main branch is designed to proceed through North-Eastern Rhodesia to Lake Tanganyika to form part of the Rhodesian section of the great meridional highway from the Cape to Cairo.

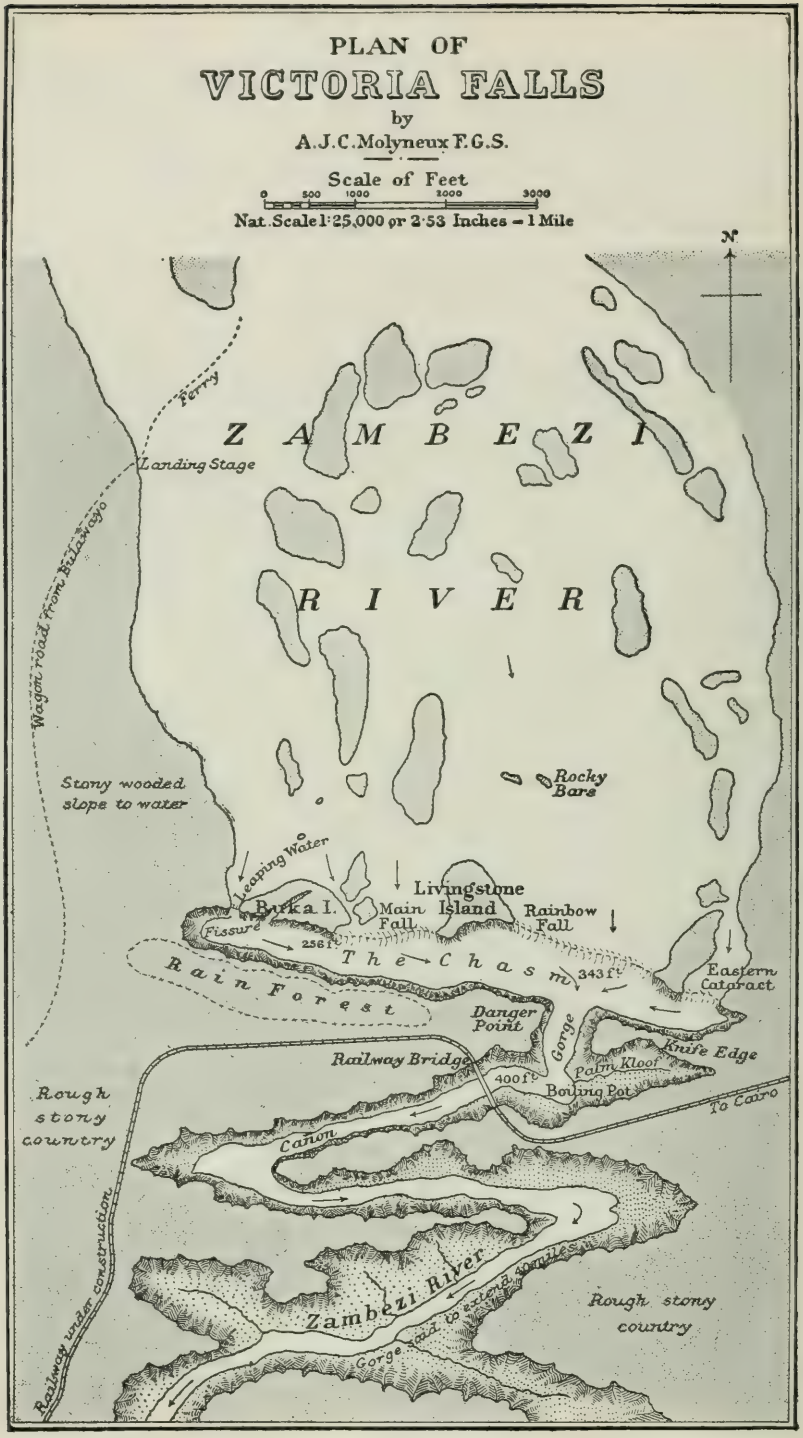
Although the Victoria Falls will play an important part in the economic development of Rhodesia when the immense power, there available, is utilised for industrial purposes, it is as one of the greatest sights of the world that they will appeal to visitors to whom they are now rendered easily accessible. The fame of these Falls has resounded through the world since they were first made known by Dr. Livingstone. It is therefore fitting that the township which has been founded in their vicinity is to bear his name. The site of the town is near the left bank of the Zambezi, some two or three miles from the Falls, and the railway line to the north passes by it.

The origin of the Falls was ascribed by Livingstone to a volcanic rift, and this view has been universally accepted. But another view has been recently mooted regarding their physical history which ascribes the origin of the chasm and cañon to erosive action.[1]

The Victoria Falls are about twice as broad and two and a half times as high as Niagara (see plan, p. 150). They are over a mile wide and about 400 feet high—higher than the top of St. Paul's Cathedral. The Zambezi at about half a mile above the Falls is one and a half miles in breadth, then it contracts and is suddenly precipitated into a comparatively narrow, profound trench or cañon, at the eastern end of which there is an outlet about 100 yards in breadth through which the whole of the contracted Zambezi rushes, forming the Boiling Pot, and thence through a deep and narrow gorge of basaltic cliffs, which is continued in a narrow winding cañon of about 45 miles in length. The railway will cross the gorge a few hundred yards below the Boiling Pot. The bridge, built on the cantilever principle, forms a handsome span 650 feet long, with a width that allows a double line of railway. When completed it will be the highest bridge in the world. The Falls themselves are not visible from the railway where it crosses the river: but, in accordance with the wish of Mr. Rhodes, the trains will pass through the perpetual spray rain while crossing the bridge. The vicinity of the Falls is celebrated for its natural beauty, and parks are to be laid out on both banks of the river. It is therefore hoped that the development of this renowned locality will combine utility and amenity.

There are two other renowned localities in Rhodesia which have led to the building or projecting of branch railways. Near Bulawayo are the renowned Matopo Hills, where Mr. Rhodes in 1896, unarmed and accompanied only by an interpreter, had an interview with the Matabele chiefs, which resulted in a speedy cessation of hostilities. Amongst the Matopos Mr. Rhodes, according to his own wish, was

[1] *Vide* "The Physical History of the Victoria Falls," by A. J. C. Molyneux, F.G.S., F.R.G.S.: *The Geographical Journal*, January 1905.


PLAN OF
VICTORIA FALLS
by
A.J.C. Molyneux F.G.S.
Scale of Feet
0 500 1000 2000 3000
Nat. Scale 1:25,000 or 2·53 Inches = 1 Mile
N
Ferry
Landing Stage
Wagon road from Buluwayo
Z A M B E Z I
R I V E R
Stony wooded slope to water
Rocky Bars
Leaping Water
Livingstone
Boka I.
Main Island
Rainbow Fall
Fissure
256 ft
T h e C h a s m
343 ft
Eastern Cataract
R a i n F o r e s t
Danger Point
Gorge
Knife Edge
Railway Bridge
Palm Kloof
400 ft
Boiling Pot
To Cairo
Rough stony country
Canon
Railway under construction
Zambezi River
Gorge said to extend 30 miles
Rough stony country

buried. A railway has been built from Bulawayo to the Matopos by the Trustees of the Rhodes Estate, as it was Mr. Rhodes's wish "that the people of Bulawayo may enjoy the glory of the Matapos from

FIG. 5.—Looking up the Gorge towards the Victoria Falls. The site of the Railway Bridge is indicated.

Saturday to Monday." The grandeur of those hills is aptly described in the words of Mr. Rhodes when he called them "The View of the World."

The other renowned locality is that of the Great Zimbabwe. The historical associations of these ancient monuments contrast with the

modern associations of the Matopos; but they have this in common, that they represent the commerce and civilisation of their respective ages. When the contemplated railway to Victoria has been built, it will give access to the Great Zimbabwe (see Fig. 3, p. 143), which is now recognised as one of the finest ancient shrines in the world.

The founder of Rhodesia and the builders of the Great Zimbabwe bring into association the British and the Sabæans, and thus unite across the ages two of the most celebrated commercial nations. How to develop and maintain communications between the coast and inland parts has been the vital problem in modern economic development, as it probably was in that of ancient times. The chief ports at present available are Chinde, Beira, and those of the Cape. To these will probably be added, in time, Durban and Lourenço Marques. Schemes have been mooted which will give access to Rhodesia from the West Coast through Angola and German South-West Africa. At present the two main highways of trade are from Beira and the Cape ports. Bulawayo, which may be taken as the central point of the Rhodesian system, is distant 676 miles from Beira; 1198 miles from Port Elizabeth; 1259 miles from East London; 1360 miles from Cape Town. There is not much difference in the amount of goods passing through Beira and the Cape ports. Much will depend, however, on the future railway administration. According to the British Consul at Beira, it would appear that under present arrangements "freights to Umtali and Salisbury, which are respectively distant 203 and 375 miles from the coast, cost approximately £5 per ton more than the railway freights to these places over the Cape Government Railways from Port Elizabeth, which traverse over 1400 miles to reach the same destination."[1] There has been some concern at Cape Town regarding the future relation of the town and port with Rhodesia; but it would seem from the above Report that there is a reasonable prospect of Cape Town, with its rapid oceanic communications, maintaining its commercial and strategic importance as the chief gateway to Rhodesia and the North.

Note.—For the figures and maps accompanying this paper, with the exception of the plan of the Victoria Falls, we are indebted to the British South Africa Company. The figures and maps are taken from a recently published pamphlet on *Railways in Rhodesia*, and the figures have been chosen in view of the coming visit of the British Association to the Victoria Falls and the Zimbabwe Ruins. The plan of the Victoria Falls is taken from the *Geographical Journal*.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

On the 7th February a meeting was held in Edinburgh, at which the Rev. W. H. Abbot delivered an Address on "The South Sea Cannibal Islands." The Chair was taken by Mr. W. B. Blaikie.

---

[1] Foreign Office Report on the Trade of the Consular District of Beira for 1902. (Annual Series, No. 3024.)

On the 8th, 9th, and 10th, Mr. Abbot repeated his address before the Glasgow, Dundee, and Aberdeen centres respectively, Mr. George K. Smith occupying the Chair in Dundee, and Mr. J. Bentley Philip in Aberdeen.

Mr. Douglas W. Freshfield addressed a meeting of the Society held in Edinburgh on the evening of the 22nd February on "The Himalayas." Prof. James Geikie presided. On the following evening Mr. Freshfield repeated his lecture at a meeting of the Glasgow Branch of the Society.

GEOGRAPHICAL NOTES

Europe.

The Lakes of Scotland and Denmark.—At a recent meeting of the Royal Society of Edinburgh, Dr. C. Wesenburg-Lund read a paper on the above subject, which is of much interest in view of the work of the Loch Survey. In the first place, Dr. Lund pointed out the striking contrast between the geological structure of Denmark and of the Scottish Highlands. Denmark is a lowland country, the highest points not exceeding 500 to 550 feet above sea-level, and geologically of recent origin, being built up of very light and friable soil, mostly derived from the moraines of those enormous glaciers which covered Denmark and the surrounding seas during the ice age. Calcareous strata of different geological ages underlie the soil, rising to the surface in certain parts, and the entire surface is very rich in lime, which is washed out by the rivers and carried into the lakes. The lakes are not numerous, and are all small and shallow, the majority being in fact merely large pools with a maximum depth of 10 or 12 feet, though exceptional depths of 120 feet have been observed, and they are mostly circular in outline, long and narrow lakes being rare. The level of the water in the lakes is highest in spring and lowest in autumn, the rise and fall amounting to 2 or 3 feet, and in summer and autumn there may be beaches several hundred feet in width, which in winter and spring are covered by ice or water. Wave-erosion is not conspicuous, but the lake-shores show in certain places remarkable indications of powerful ice-erosion. When the ice breaks up in spring it is piled into heaps, having in front a conspicuous "end-moraine," consisting of gravel, stones, broken *Phragmites*, shells, etc., which may be pushed 20 or 25 feet from shore, and remain there from year to year, and when the ice disappears the ground shows a conspicuous "bottom-moraine," consisting of shells of *Anodonta*, etc., scattered in thousands over the ground. The ice striking against the trees injures or kills many of them, and makes great apertures in the closed stocks of *Phragmites* and *Scirpus*, casting large patches of rhizomes on shore. The ice may in the course of a few hours cover over a peaty shore with sand, or a sandy beach with peaty material. Most of the Danish lakes are frozen over nearly every winter, while in summer the surface water is generally very warm, so that the annual range of temperature is large—

from below freezing-point to about 73° F. On the other hand, Scotland is a mountainous country, the highest points exceeding 4000 feet above sea-level, and geologically ancient, being built up mostly of hard rocks, in which lime plays an inconspicuous part, so that the quantity of lime washed out by rivers and carried into the lakes is inconsiderable. The rainfall is considerable, and the Scottish rivers, with their rapid flow, elevated sources, waterfalls, and great eroding powers, are quite different from the little Danish brooks.

Lakes are numerous, and, though generally of moderate size, many of them are much larger than the Danish lakes, from which they differ especially in their great depth, often exceeding 500 feet, and in one case (Loch Morar) exceeding 1000 feet, and they are mostly long and narrow, none of the larger ones being circular. The level of the lakes may rise and fall rapidly at any time of the year, unlike the regular, slow, and comparatively slight rise in spring and fall in summer observed in the Danish lakes. The precipitous shores of the Scottish lakes Dr. Lund considers one of their most prominent characteristics (generally surpassing in this respect the alpine lakes of Switzerland), so that depths of 500 feet may be met with a short distance from shore, and beaches are very narrow or entirely absent; river deltas and banks of detritus are common, and wave-erosion is often very conspicuous. The larger Scottish lakes are never ice-bound, and the winter temperature is generally from 41° to 45° F., while the maximum temperature never exceeds 61° to 64° F., so that the annual variation of temperature is much less than in the Danish lakes. The transparency is not much greater in the Scottish than in the Danish lakes; but the regular seasonal alterations in the colour of the water in the Danish lakes are unknown in the Scottish lakes, which vary little in this respect all the year round, the water being usually very clear, but of a yellowish brown colour. Dr. Lund dealt in great detail with the animal and plant life in the Danish and Scottish lakes, considering the associations of organisms in the three main regions recognisable in every lake—viz., the *littoral*, the *pelagic*, and the *abyssal* regions. The littoral region in the Danish lakes is characterised in most places by dense and luxuriant bands of vegetation, arranged in zones according to the depth of water. This rich vegetation is the home of numerous animals. The pelagic region in the Danish lakes is nearly always extremely rich in plankton, so much so that during the greater part of the year it influences the colour and transparency of the water, and is a prominent factor in determining the amount of oxygen and carbonic acid dissolved in the water, thus greatly influencing all other forms of life in the lakes. In the shallow Danish lakes there is, strictly speaking, no true abyssal region, but still it is possible to speak of an abyssal fauna, which is quite different from the littoral fauna. Turning to the forms of life in the Scottish lakes, the greatest differences are observed in nearly every respect. In the littoral region of the larger Scottish lakes there is seldom a belt of higher vegetation as in most Danish lakes, and when it does occur it is not arranged in zones. The animal life in this region struck Dr. Lund as being very poor when compared with what is observed in the Danish lakes, but his visit was made

during the season when the animal life is at its minimum. The paucity of Mollusca in the littoral region of the Highland lakes is very different from their abundance in the Danish lakes, and Dr. Lund thought was due to the large amount of humic acid, and the total absence of lime, in the water of the Highland lakes. The common plankton-organisms found in the pelagic region of the Scottish lakes occur also in the Danish lakes, but many forms are known from the latter which have not hitherto been observed in the Scottish lakes. The quantity of plankton observed in the Highland lakes is much less than is found in the Danish lakes, and only to a very slight extent does the plankton affect the transparency and colour of the water; it is, further, exceptional for a single plankton organism to give the entire plankton the uniform character frequently observed in Danish lakes. The abyssal fauna of the Highland lakes appeared to Dr. Lund to be poor, and this he ascribes to the large amount of humic acid in the water, which acts as poison to many animals.

Survey of Iceland.—According to *Petermann's Mitteilungen*, the Danish Government began the survey of Iceland as soon as that of the Faroes was completed. Much of Iceland has never been accurately surveyed, triangulation having been carried out in only a few parts of the island. The least known region is the southern coast, which is impassable in summer owing to the quicksands, and also the inland ice-masses of the Vatna Jökull, and it is here that a beginning has been made with the survey. During the summer of 1903 a plan of the survey was laid down by means of a preliminary expedition, and in the spring of 1904, so long as the frosts made it possible to cross the morasses and streams, a part of the southern region in the district of Skeideraasande was surveyed. A second survey party was detailed to study the inland ice. One result of the work was to show that the highest point of the island is Hvannadalshnukr, which is 2120 metres, and not, as has been hitherto supposed, the Oraefa Jökull, which is only 1959 metres. In all about 100 Danish square miles, that is 5700 square kilometres, have been already surveyed.

Asia.

Expedition to Turkestan.—Mr. Ellsworthy Huntington and Mr. Robert L. Barrett, two American explorers, left London on 3rd February with the object of devoting two years to a thorough examination of the entire rim of the great Tarim basin in Chinese Turkestan. Both have had previous experience in Asiatic travel; but the former alone has done exploring work on any extensive scale. They are proceeding, in the first place, to India, where, however, they do not propose to make any lengthened stay, travelling almost directly from Bombay to Kashmir, whence they will make their way over the well-known Karakorum Pass to Kashgar, which is situated at the western end of the Tarim basin. On arriving at the north-eastern corner of the basin it is the intention of the explorers to make a side expedition in a north-easterly direction for the purpose of visiting the Turfan depression, which is so

remarkable from the fact that, though situated in the heart of the great Central Asiatic plateau, it is reported to be a few feet below the level of the sea. If all goes well, they hope to have reached this point about twelve months after beginning their exploration of the basin. Instead of coming home either by Europe or by India, their intention is to strike southward across the immense mountain barrier guarding Northern Tibet. Once in Tibet, they will take an easterly line through the great salt swamp of Tsaidim for Kuku Nor, and afterwards strike across China for some port on the Pacific Coast.

Africa.

The New Port for the Sudan.—A Reuter dispatch, dated Cairo, January 23, says that the name of the new Sudan port has been altered from Sheikh Barghut to Bandar Sudan. The same telegram stated that it was expected that telegraphic and telephonic communication would soon be established between Suakin and Bandar Sudan. Sheikh Bargut is the port also known as Mersa Sheikh Barud, and lies about 30 miles north of Suakin (cf. this *Magazine*, xi. p. 573).

Polar.

The Argentine Relief Ship.—A telegram from Buenos Ayres, dated January 30, reported that the Argentine sloop-of-war *Uruguay*, which left Buenos Ayres on December 10, had returned to Punta Arenas, in the Straits of Magellan. As was stated here (p. 48), the *Uruguay* went down to the Meteorological Station at the South Orkneys with a relieving party, but she was also to endeavour to obtain news of the Charcot Antarctic Expedition. The officer in command of the *Uruguay* has telegraphed to the Argentine Minister of Marine that he passed through Bransfield Strait, and the Belgica Strait, and reached longitude 61° 57′ without obtaining any news of the expedition, either on Deception Island or on Wiencke Island, where the French expedition arranged before quitting Buenos Ayres to leave a record describing its movements. It is therefore supposed that the expedition was obliged to follow another route from that previously agreed upon. A later telegram announces the safe arrival of Mr. Mossman at Buenos Ayres in the *Uruguay*.

Amundsen's Expedition to the Magnetic Pole.—Information in regard to the progress of this expedition has been received through a whaler, which picked up a document in Barrow Strait, and brought it to Christiania. The document is dated so long ago as August 1903, and was written on Beechy Island. It states that the expedition left Dalrymple Island, which lies to the north of Melville Bay, on Sunday, August 16, 1903, after having laid down a depôt there, under very favourable conditions as regards weather. From Dalrymple Island a westerly course was taken, and it was found that Wolstenholm Sound was free of ice, though a number of icebergs had grounded at the mouth of the sound. From the Carey Islands the course was directed to Cape

Horsburgh, which is a little to the north of Lancaster Sound, and was reached on August 20. Here the water was clear and still, with only few icebergs. Round Philpots Land there was a narrow band of pack-ice, but the sound was free from ice. Beechy Island was reached on August 22, also under favourable ice conditions. The depôt laid down under British auspices on Beechy Island was found to be completely destroyed, but the Franklin Memorial, and the graves near, were found intact. From the depôt some coal was taken. The magnetic declination was here found to be about 135° W., and the inclination about 88·5°. Some geological collections were made here. At the time of writing the intention was next to proceed to Peel Sound. All on board were well. In a postscript Amundsen states that the record was left in a metal case at the Franklin Monument. As Amundsen reckoned to pass his first winter on Beechy Island, the record shows that the favourable condition of the ice has enabled him to get further than he expected.

The Ziegler North Polar Expedition.—The *Terra Nova*, the second relief ship of the *Discovery* Expedition, has been purchased for use as a relief ship for the Ziegler Expedition. It will be remembered (cf. this *Magazine*, xx. p. 607) that Mr. Champ made two attempts in the *Frithjof* last year to reach the *America*, both of which proved unsuccessful. Mr. Champ states that the *Terra Nova* has been bought "because she is regarded as the strongest and most suitable vessel afloat for the purpose in view. She will be specially equipped, and will leave England on June 1. Her commander is Captain Kjeldson, who has been in charge of all the relief ships, and is an undoubted authority on Arctic navigation, currents, and ice work. Besides the *Terra Nova*, which will go direct from Norway to Franz Josef Land, another Arctic vessel will be employed to visit the depôts established in 1901 on Shannon Island and Bess Rock Island, on the east coast of Greenland, in order to see whether any of the members of the expedition have returned from their sledge journey in that direction owing to the drift. In possessing the *Terra Nova*, the relief will have the most essential factor in carrying to a successful issue the objects in view. For, even with the same adverse conditions as those experienced last year, there is practically no doubt that a ship of her size and strength will be able to reach Franz Josef Land, and once there we shall learn from the records which it had been arranged were to be deposited the whereabouts and doings of Mr. Fiala and his companions. It is impossible to say what the explorers have been doing during their long sojourn in the ice, but it is probable that the *America* has wintered between 81 and 82 degrees on the Franz Josef Land archipelago. Whether any of the party are on board, or whether they have been in winter quarters on the land, it is impossible to say." The *America*, with Mr. Fiala and party on board, has now been in the Arctic regions since July 1903.

Peary's New Arctic Expedition.—Commander Robert Peary proposes to start on his new Arctic journey on March 1. His ship has

been equipped with a wireless telegraphy system, which Commander Peary believes will prove of the greatest service. He will establish relay stations in Greenland, and in this way expects to be able to communicate with the existing telegraph headquarters at Chetau, in Labrador, and from there by direct line to Montreal.

The "Discovery" Antarctic Expedition.—In the *Geographical Journal* for February, Mr. George Murray, F.R.S., records the finding, during the voyage of the *Discovery*, of a new genus of pelagic Algæ. This new form is described as *Clementsia Markhamiana*, *n. g. et sp.*, was found in lat. 7° S. to 12° S., long. 30° W. to 33° W., and is remarkable in that its nearest allies are fresh-water forms.

General.

The German Observatory in the Samoan Islands.—The German Government has decided to continue the Meteorological and Magnetic Observatory at Apia, Samoan Islands, which was originally only intended to remain open during the activity of the British and German Antarctic expeditions. Dr. Franz Lincke has been appointed to take charge of the Observatory in place of Dr. Tetens, who returns to Germany in order to reduce the records obtained during the last two years. The Observatory is placed on the opposite side of the magnetic equator to that of the Magnetic Observatory of the Coast and Geodetic Survey of the U.S.A. in the Hawaiian Islands, and arrangements have been made to ensure effective co-operation between the two observatories.—*Science*, xx.

The Relation of Oceanography to other Sciences.—At a meeting of the *Challenger* Society, held on January 25, Sir John Murray, who was in the Chair, read a paper on this subject. He pointed out that recent expeditions had made only inconsiderable alterations in the contour lines of the sea-bottom published in the *Challenger* Reports, and stated that he was of opinion that no great changes were likely to be made by the soundings of future expeditions. He expressed his belief that the great ocean basins had been practically unaltered through geological time, but that the continents (including a zone not more than 200 miles seaward of their present outline) had frequently altered their levels, supporting this belief by the fact that all known sedimentary rocks are of "terrigenous" character, to the exclusion of deep-sea material. The meteorology of mid-ocean, where the diurnal temperature range of the water is about 2° F., was contrasted with the meteorology over land-masses, where absorption and radiation are high, and the diurnal atmospheric range may amount to 80° F. As an example of the far-reaching effects of temperature, Sir John cited the range of annual variation where hot and cold currents are at war, amounting in some cases to over 40° F.; in such regions the animal death-rate is very high, and the dead organisms decomposing on the bottom start the formation of glauconite, a well-known constituent of sedimentary rocks.

As another result of temperature, it has been estimated that a tropical copepod lives twenty-four times as fast as an Arctic copepod in the same period of time. This may explain the predominance of specimens and paucity of species in the Arctic as compared with the tropical fauna. In connection with chemistry, Sir John pointed out the gradual transference of lime from the poles to the tropics by organic agency; and in connection with physiology, the possible relation between the serous and similar fluids of existing animals, and the constitution of the primeval sea in which life first began upon our earth.

Sir John Murray, K.C.B., F.R.S., has recently been elected an Honorary Member of the Geographic Society of Chicago, and a similar distinction has been conferred upon him by the Boston (Massachusetts) Natural History Society.

Mrs. Fanny Bullock Workman has, according to *La Nature*, been appointed Officier de L'Instruction Publique for her travels in the Himalayas.

Commercial Geography.

Proposed Railways in the Philippines.—The Bureau of Insular Affairs has prepared some particulars in regard to the proposed new lines in the Philippines. Eight lines are discussed, four of them in the island of Luzon, and one each in Panay, Negros, Leyte, and Cebu, and reference is made to the desirability of one or two short lines in Mindanao. The most important of the proposed lines in Luzon is that to run from Manila to Aparri, at the mouth of the Cagayan river, on the north coast of the island. The length of this proposed line, for which preliminary surveys have been made, would be 336 miles, and it is estimated that it would cost 6,675,000 dols., or about 20,000 dols. per mile, to construct it. Another Luzon line, for which preliminary surveys have been made, is proposed to run from Dagupan, the present northern terminus of the Manila-Dagupan line, in a northerly direction, following the west coast to Laoag, in the province of Ilicos Norte. This line would be 168 miles long, and its estimated cost is 3,367,000 dols. The third and last of the lines for which preliminary surveys and estimates of cost have been made is that from Manila south to Batangas, about sixty miles. The estimated cost of this line is 1,097,457 dols. Another important line is proposed to run from Pasacao on the west coast of the province of Ambos Camarines to the ports of Tabaco and Legaspi. This would tap the great hemp region of Luzon. In the island of Panay, which has a population of 743,646, a railway is proposed from Capiz, on the north coast, to Iloilo on the south coast, traversing the heart of the island. A line is recommended from Escalante, on the north-east coast of the island of Negros across the island and down the western coast. This line would have a tributary population of 184,889. The line proposed in Leyte is comparatively short, from Tacloban, on the north-east coast, westerly to Carigara, on

Carigara Bay. The proposed line in the island of Cebu is to run from Davao on the east coast in a south-westerly direction across the island to Dumaguete. Cebu is the island in which the greatest coal developments have been made, and the port of Cebu is the third most important in the archipelago.

New Mineral District in Quebec.—In the opinion of Mr. J. Obalski, Inspector of Mines for Quebec, who has returned from the region some two hundred miles north-west of Lake St. John, around Lake Chibougamau, an important new district for mining investigation and development will shortly be added to the known resources of that province of Quebec. It is within a hundred miles of the probable route of the proposed Government Trans-continental railway. The discoveries include copper ore, magnetic iron, gold, and asbestos. Some specimens of gold-bearing quartz were taken out by Mr. Obalski from a vein measuring 30 feet in width, which was traced for over 2000 feet, and where all the indications pointed to a considerable gold-bearing section. Perhaps of greater importance still was the discovery of a large belt of serpentine rock, from which were taken some fine samples of asbestos, the fibre varying from an inch to 3 inches in length. The province of Quebec is said to contribute about 80 per cent. of the world's production of asbestos, and the new discovery may easily make a valuable addition to the supply. There have also been found what are probably extensive veins of copper ore, carrying boinite, also of iron pyrites and magnetic iron. An abundance of timber exists in the district, suitable for pulp-wood, and excellent water-power.—*Board of Trade Journal.*

Railways and Agriculture in Argentina.—According to an Argentine correspondent, arrangements have been completed for the construction of cheap narrow-gauge railways in the province of Buenos Ayres. The concession comprises direct lines to the port of La Plata, to the Federal capital, to Bahia Blanca, and to a point on the Parana River. It also includes lines penetrating the agricultural belt on the west and south of the province, besides numerous branches crossing the districts hitherto without a railway service, but which will now be opened up to agriculture.

The same correspondent forwards us the enclosed balance-sheet, which may be of some interest to our readers:—

Calculated stocking and returns from an Argentine estancia of 10,000 acres of land, all laid down in "alfalfa" (lucerne), fenced in and subdivided into paddocks varying from 400 to 1000 acres, with windmills, tanks and troughing, buildings and sheds complete. Cost of stocking:—10,000 acres laid in alfalfa, fenced, with buildings, etc., at £4 per acre, £40,000; 4000 head of cattle at £4, £16,000; 4000 head of sheep at 14s., £2800; 30 bulls at £40, £1200; 40 rams at £8, £320; 150 mixed horses, mares, colts, at £3, 10s., £525; giving a total capital value of £60,845.

The returns are estimated as follows:—500 3 to 3½ year old steers at £6, 10s., £3250; 400 cows or heifers at £4, £1600; 14 tons wool

at £60, £840; 700 wethers at 16s., £560; 550 ewes at 12s., £330; sheepskins, cowhides, tallow, horsehair, etc., say £50; making a total of £6630, less working expenses, say £1500, giving a net revenue of £5130, which is 8½ per cent. on the capital outlay.

The Economic Future of Africa.—In the *Geographische Zeitschrift*, xi. 1, Professor Karl Dove discusses at some length the probable development of the African continent, some of his figures being very striking. At present Africa has less than six inhabitants to the square kilometre. A rough estimate of the area of the continent gives 14·3 millions of square kilometres of forest and arable land, about 8·5 millions of square kilometres of steppe land, which is still capable of maintaining a certain proportion of human beings, and about 7 millions of square kilometres of desert and useless land. Reckoning that one square kilometre of forest and arable land is capable of supporting fifty persons, we find that Africa should support at least 700 millions of people, that is more than 500 millions more than it at present supports, and about as many as now inhabit South and East Asia. But, on the other hand, it must be recollected that a great part of this vast area must necessarily remain the heritage of the black indigenous tribes, for it is never likely to become available as a settlement for Europeans. Professor Dove reckons that only about 700,000 square kilometres in the north, and about two millions in the south, can be regarded as suitable for European colonisation. As regards the mineral wealth, it does not as yet appear that coal is anywhere present in quantity. As regards the plants, the conditions are such that only those which can be readily cultivated by the natives themselves are likely to be of great importance in the future, and among these cotton is probably destined to become the most important.

Perhaps the greatest obstacle in the development of the continent, however, is found in the marked inferiority of the natural means of communication. Natural harbours are few and poor, and in all the great areas there are practically only three good waterways leading to the interior, these being the Nile, the Niger-Benue system, and the Zambezi-Nyasa system. The lower part of the Congo only is available, but the internal network of that system constitutes an invaluable means of developing the interior. Apart from the natural waterways inland communication is costly and difficult, for in not a few regions the only available means of transport is that which is the worst and most costly of all—that is, man himself. There can, therefore, be no doubt that the future of Africa is bound up with the development of its railway system. The author gives a table comparing the length of the existing African railways per 10,000 square kilometres of area with those of other continents, and calculates that something like 81,000 kilometres of new railways are required for the full development of the country. Another table gives some interesting comparisons between the cost of the various possible means of transport in Africa, and that on the Prussian State Railways. This table shows that on the South-West African Railway from Swakopmund to Windhoek the cost per ton is

about three times as much as on the Prussian railways, but by ox wagon, on the tariff prevailing at Windhoek, the cost would be nearly twenty times as much as on the Prussian railway, while if carried by porters the cost of transport would be forty times as much. Thus, even though African railways are much more costly than those of Europe, yet they represent a very large saving as compared with existing modes of transport.

NEW BOOKS.

EUROPE.

Memoirs of Geological Survey of the United Kingdom. The Tertiary Igneous Rocks of Skye. By A. HARKER, M.A., F.R.S. With Notes by C. T. CLOUGH, M.A., F.G.S. Printed for H.M. Stationery Office. 1904. Pp. 482, with 27 Plates and a Map. *Price* 9*s.*

This very complete and valuable memoir is one of the most important issued by the Geological Survey. It is based mainly on the area mapped by Mr. Harker, which embraced the Cuillen Mountains and the Red Hills, the basaltic plateaus lying west and north-west of those elevated tracts, the island of Scalpay, etc. The author, however, has freely availed himself of the information supplied by his colleagues who have mapped other areas of Skye in which Tertiary igneous rocks occur. Detailed descriptions are given of the field-relations and petrography of the volcanic series, of the plutonic masses, and of the various minor intrusions—the several series of rocks being described as far as possible in chronological order. It is impossible to speak too highly of the clearness with which the complicated phenomena are set forth in this memoir. Mr. Harker has demonstrated that the entire assemblage of igneous rocks form a connected whole, and that they are the records of a prolonged period of igneous activity which has manifested itself successively under three different phases—the Volcanic, the Plutonic, and the "Dyke Phase," or, as he prefers to call it, the Phase of Minor Intrusions.

The earliest stage in the igneous history of the island was marked by the opening of several large volcanic vents within a limited area in the central part of the island. There can be little doubt that these great volcanoes were subaerial —the land standing higher above sea-level than now. Although the eruptions at this stage were of a violently explosive kind—some of the vents attaining diameters of one or two miles—they were of less importance than the eruptions of the next succeeding stage. These last had a regional extension, and took the form of tranquil outpourings of lava from a system of parallel fissures. By prolonged extravasation of this kind a wide extent of country was eventually entirely buried, so as to form a vast plateau-land, of which the existing basaltic plateaus of Skye are but a fragment. When these fissure-eruptions began, small outbursts of the explosive type had not quite ceased, and would appear to have been more frequent and to have continued later in the immediate neighbourhood of the volcanic focus of Central Skye. As the upper part of the plateau-basalts has been removed by denudation, it is not known whether any special phenomena attended the extinction of regional volcanic activity.

During the Plutonic Phase regional activity was wholly in abeyance. This phase was marked by the successive intrusion of ultra-basic, basic, and acid rocks

respectively. These intrusions appear as enormously thick lenticular sheets (laccoliths) and bosses, and do not seem to have had any connection with the volcanic basalts. In short, they cannot be considered as in any sense representing the cores of volcanoes. The earliest intrusions (ultra-basic) are remarkable for their extreme complexity of structure—the same mass being composed of quite a large number of rock-types. To these intrusions succeeded that of the basic gabbros, which are developed on a much larger scale—the most important mass being that from which the Cuillens and the Blaven range have been carved out. The latest plutonic intrusions are granites and granophyres.

The Phase of Minor Intrusions was characterised by the invasion of basic magma in the form of sills or sheets, collectively of enormous volume, intruded among the plateau basalts and the underlying strata. The intrusion of these sills (which had no connection with the Skye focus) was followed by a long succession of local and regional episodes. The local episodes were characterised by the intrusion of both dykes and sheets, with a wide range of petrographical variety; while the regional episodes were marked by a vast number of basic intrusions in the form of dykes with a predominant north-west trend.

Although this volume is written by an expert for experts, yet the subject is handled so admirably that, as we have already indicated, any one with even a moderate knowledge of petrography and geology should have no difficulty in following the author. The book is very well illustrated—the figures in the text being, like the text itself, clear and instructive, while the geological sketch-map of Central Skye, and the beautiful plates representing micro-sections, structural features, and mountain-forms add greatly to the value and interest of the work.

ASIA.

India. By Col. Sir Thomas Hungerford Holdich, K.C.M.G., K.C.I.E., C.B., R.E. London: Henry Frowde, Oxford University Press, 1904. *Price 7s. 6d.*

The learned editor of "The Regions of the World" series was exceedingly fortunate in being able to secure Sir Thomas Holdich as the writer of a monograph on India. Sir Thomas, with characteristic modesty, speaks of it in the note which serves as a preface to the work as "a little book." We rise from its perusal, convinced that those who read it will carry away with them a profound yet true impression, that India is a vast empire, entailing on us onerous responsibilities and imperious duties, which the man in the street even in the beginning of the twentieth century hardly realises, and which grow greater and greater instead of lessening as time rolls on. This important book has its lessons for the geographer, the historian, the philologist, the ethnographer, the politician, and the political economist, and it is tantalising to find that great problems in science and statesmanship have been merely stated instead of being adequately discussed by an authority who is eminently qualified to throw much light on them. In such a work it was obviously necessary to avoid details and statistics as much as possible; but Sir Thomas has supplemented his own observations by references to other authorities which the student can consult at his leisure; and probably one useful result of this book will be the revival of interest in India and a more careful study of the recognised authorities on its many problems—a consummation devoutly to be wished in these days, when the capabilities of our colonies and dependencies and their economical correlation to the requirements of the mother country are so much under discussion. For example, it is highly expedient that English statesmen in these days should remember, when discussing the food

supplies of the Empire, that the wheat grown in the Punjab alone is twice as much as that of Great Britain, and quite as much as the total of the United States of America, and that practically the whole of that wheat is available for export. The book is divided into twelve chapters, the first of which gives an erudite and interesting account of early India. The next three chapters give a description of the frontier provinces, viz. Afghanistan, Baluchistan, Kashmir and the Himalayas, and probably it is no exaggeration to say, that Sir Thomas Holdich is the greatest living authority on these countries. The fifth and sixth chapters deal with the geography of the Peninsula, Assam, Burmah, and the island of Ceylon, which is naturally treated as a part of India in this work. The remaining chapters are devoted to India, its people, its political geography, agriculture and revenue, railways, minerals and climate. Unquestionably it has to be admitted that these important subjects are not dealt with in an exhaustive way. The limits of the work did not admit of such treatment, but the work is a model of judicious condensation; and those who know India, or even a part of it, will be the first to admire the just proportion assigned to each subject, the sagacity with which doubtful or unsolved problems are treated, and the kindly and sympathetic appreciation with which Sir Thomas regards the natives and even the half-castes. Every chapter offers convincing proof that he is treating of what he has carefully and exhaustively studied, and that his powers of observation and the acumen which he has brought to bear on his task are of the highest order; in fact, they are such as we would expect from an officer of his experience and reputation.

It is unfortunately obvious that the bulk, if not all of this work, was written before the statistics of the census of 1901 were available, and we presume that this will be remedied in future editions. As in all the works of this series, free use has been made of maps to convey to the reader swiftly and accurately an idea of the statistics, without which the various subjects taken in hand would hardly be intelligible. The maps are based on those of the Survey of India, which is an ample guarantee of their correctness.

The Campaign with Kuropatkin. By Douglas Story. London: T. Werner Lawrie, 1904. Pp. xii + 301. *Price* 10*s.* 6*d.*

This is a fluent and straightforward account of the War from an experienced Scotsman specially accredited to the Russian forces. Naturally he gives the story from the point of view of that side, and when we hear so much in the daily papers from the side of our allies, the Japanese, it is useful to listen to one who speaks for their opponents. But the picture drawn in these pages is too *couleur de rose.* We can only regard it as a scene viewed through tinted glasses, which moreover curtail the field of vision. Mr. Story gives us a sketch of Russian history to prove that the one national desire of the people since the days of Ivan the Terrible has been to secure an open-sea port, and that for this alone, they have conquered the width of Northern Asia. With the acquisition of Port Arthur, as he admits, they attained their desire. But after these centuries of expansion could we expect them at once to halt? In their Pekin Railway, in their concessions on the frontiers of Tibet, and otherwise, we have too good evidence to the contrary, and we are not able to accept the author's inspired dictum that Russia does not desire India. At the same time we are bound to give weight to the view expressed, that if Russia is denied access to the Yellow Sea, she will all the more press her claims at some other point, such as the Dardanelles, or the Persian Gulf, where likewise she is confronted by this country. There are many details of interest in the book—the rejected warning as to the attack upon Port

Arthur, the remark that the Goorkhas would have done better than either side in the hills, that the Japanese do not follow up an advantage, the references to the Cossacks, to the barber at Newchang who shaved the Russian officers and who was a Japanese captain, and the tribute to Count Keller. We must add, however, that the author overrates the importance of newspaper correspondents in a campaign.

The Travels of Marco Polo, the Venetian. London: George Newnes, Ltd. Pp. xxxix + 461. *Price* 3*s.* 6*d.*

The story of these six-hundred-year-old travels through Asia to Pekin has been included in the "Thin Paper Series," and excellent reading it is. The text is that of Marsden and Wright, further abridged, though why the later and more scholarly text of Sir Henry Yule is rejected is not explained. As the preface informs us, "a series of maps, a genealogy of the Khans of Tartary, a list of contemporaneous events, and a very complete index, have been added."

AUSTRALASIA.

The Native Tribes of South-East Australia. By A. W. Howitt, D.Sc. London: Macmillan and Co., 1904. Pp. xix + 819. Fifty-nine Illustrations, and ten Maps. *Price* 21*s.*

To those who interest themselves in the ethnology and psychology of the aboriginal Australians no name is better known than that of Mr. Howitt. As far back as 1880, in collaboration with the Reverend L. Fison, he published *Kamilaroi and Kurnai*, and the Anthropological Institute has been indebted to him for many valuable communications on the Beliefs, Initiation Ceremonies, Tribal Systems of the Natives, etc. In the present volume he has brought together the result of his own studies, and of the observations of a number of correspondents who have furnished him with information for the last quarter of a century.

The student, who is occupied with the study of man in early stages of civilisation, who wishes for material from which to form a picture of prehistoric times at the very beginning of the later Stone Age, will find ample stuff in Mr. Howitt's new work. It must not be imagined that, because from a material point of view the Australians are at a very low stage of civilisation, that for that reason their mental condition lies at a correspondingly low level. They make use of their brains. In some tribes the members are divided into two totemistic classes A B, which intermarry. A man of class A can only marry a woman of class and totem B, and their children belong to the mother's class and totem. A regulation of this kind operates in the direction of preventing incest between brother and sister, as the brother can only marry a woman of a different totem from himself. But it is clear that such a division of the tribe does not of itself avoid the possibility of incest between a father and daughter, as they belong to different classes. Apparently, with the express purpose of obviating this danger, other tribes have subdivided themselves into four classes by splitting each of the original two classes. When this is the case a man of A can only marry a woman of D, and their children belong to class and totem C; a man of class B can only marry a woman of class C, and their children are assigned to class D. By this new tribal arrangement a man can never marry his daughter as her totem is not one which permits of this, and as the brother and sister belong to the same totem and class they are equally precluded from marrying each other. Here then we find one section of the moral law efficiently and purposely carried out in an automatic and mechani-

cal manner which does credit to the ingenuity of the native Australians. Any violation—though it rarely happens—of the strict tribal law which prohibits sexual union between persons of the same or of a prohibited totem, is invariably punished by death.

Although the Australians represent a fairly early stage of civilisation, it is not everywhere on the same dead level, and there are many diversities among them. Some tribes have risen from the plane at which descent is reckoned through the mother to that where it counts through the father. In others, instead of two or four classes, there are eight. Not only is the spoken language quite different in different localities, but the gesture language is not the same over the whole country. Some tribes have initiation ceremonies at the period when a youth becomes a man, others have none, and where the ceremonies exist they can be divided into an eastern and a western rite. There are various ways too of disposing of the dead. Inhumation and cremation are both in use; sometimes the body is placed on a platform, and occasionally for some special purpose it is eaten.

In short, this stout volume is a mine of information, and concludes with an appendix, containing a number of very curious native legends. The maps are good, and the photographic illustrations are all that can be desired.

GENERAL.

Glossary of Geographical and Topographical Terms and of Words of Frequent Occurrence in the Composition of such Terms and of Place-Names. By Alexander Knox, B.A., F.R.G.S. London: Edward Stanford, 1904. Pp. xl + 432. *Price* 15*s.*

In this supplementary volume to *Stanford's Compendium of Geography and Travel*, the author has collected a vast amount of information invaluable to the geographical reader. The introduction contains also very useful explanations of the consonantal variations in Arabic names and of word-construction in the Bantu languages, etc. It is hardly to be expected that a work containing such a large number of interpretations should be free from errors, and indeed a few are to be found in it, but on the whole it appears to have been very carefully compiled. What strikes one most is the absence of the names of well-known countries and towns, such as Dominica, Mexico, Alaska, Lima, Hongkong, Funchal, etc. To make room for these, Anglo-Saxon and Celtic place-names in the British Isles might have been omitted, as there are books which treat of them more fully, and many ordinary French and German words, familiar to most educated men and to be found in the smallest of dictionaries, might also be spared. As regards place-names, a dictionary of the names themselves, instead of their constituents, is, perhaps, more satisfactory, for the interpretation of, say, Hainan ("in the south of the sea") is not at once apparent from the meanings of *hai* ("sea") and *nan* ("south"), nor would any one look for Jamaica under X (*Xaimaka*), unless he knew the derivation already, or was acquainted with Spanish pronunciation.

The Story of My Struggles: The Memoirs of Arminius Vambéry, Professor of Oriental Languages in the University of Budapest. London: T. Fisher Unwin, Paternoster Square, 1904. *Price* 21*s.*

It is probable, perhaps we might say it is inevitable, that these volumes will evoke a great variety and diversity of opinion. That they are most interesting and entertaining goes without saying. Anything that Professor Vambéry—who is

probably now the *doyen* of explorers—may write, especially when of the nature of an autobiography, must be instructive and interesting. But even with regard to this there may be a difference of opinion, viz. whether *The Story of My Struggles* is more interesting than his *Life and Adventures*, the great popularity of which, at least among the Anglo-Saxon peoples of the world, was more than proved by the number of editions through which it passed. These volumes bring down the story of the Professor's life to the year 1904.

To many of his readers the most interesting part of these two volumes will be the first chapters, in which the Professor describes the hardships and struggles of his early days. He commenced his life in Hungary handicapped by two disadvantages, either of which was sufficient to disqualify an ordinary man there from success in life. He was a Jew and he was a cripple ; and to these may be added that he had from his tenth or eleventh year literally to earn his own bread. His descriptions of the straits to which he was from time to time reduced are painful reading. For instance, he relates that in Presburg "I had no credit even for a single meal. The state of my feelings, as I sat at dinner-time in a corner of the room, trying in vain to keep my eyes fixed on my book, and feeling all the gnawing pains of hunger, may well be imagined, and now and then I could not help stealing a glance at the students and tailors as they sat at table enjoying their meal. This eager hungry look of a starving lad seemed sometimes to appeal to them, for now and then one or other of them would make a sign to me to finish the vegetables he had left ; or some one pressed a piece of bread into my hand ; so that I generally managed to get a trifle to still the worst pangs of hunger. . . . It was chiefly to cooks and housemaids I gave lessons in reading and writing. In some cases where I had inspired great confidence I was employed to write billets-doux, and in return for this service of love I received a good meal, sometimes even dainties. I always found that cooks were the persons who most indulged in love-letters." When he succeeded in getting a little higher up the ladder, he gave lessons in Hungarian, French, and Latin for two florins a month, or about a penny an hour. The glamour of the East had already effectually captured the imagination of the young scholar, and when he had saved a few florins, insufficient indeed to pay his expenses, he turned his face to Constantinople, and there his battle with fortune was renewed under different circumstances. His being a Jew was no disadvantage ; his being a Hungarian was distinctly in his favour ; he had given up his religion and become a free-thinker ; he was a sincere and earnest student of Islam ; and his thorough knowledge and command of Turkish inspired universal confidence. After some weeks during which he never knew when or how he would get his next meal, he began to earn a trifle by singing, or rather by intoning, love-songs in coffee-houses, and after a spell of that, he recommenced his career as teacher and tutor, and in this capacity, owing to his marvellous proficiency in many languages, he, under the name of Reshid Effendi, secured a footing in the households of several high officials. The names we meet with in this interesting part of the Professor's story sound now like a chapter of ancient history, viz. Midhat Pasha, Ali Pasha, Fuad Pasha, and others, notorious in the days of the Sultan Abdul Medjid, or as Mr. Gladstone called him, Abdul the Damned. It was under the auspices and with the help of these Turkish officials that the Professor started on his famous journey to the East, which at first placed him in the front rank of travellers and adventurers. On his return in 1864 he met with a characteristically frigid reception from his compatriots in Hungary, a marked contrast to the enthusiasm with which he was received in London, where Society apparently did its best to spoil him. He was commanded to go to Windsor, where he was

lodged in one of the round towers of the palace, and of this experience he writes: "I was deeply moved at the wonderful change in my position. If some one had told me in the days gone by that I, who was then living in the poorest circumstances, and even suffering hunger, should one day be the honoured guest of the Queen of England and Empress of India at Windsor, that men in high position would lead me through the ancient halls, show me the royal treasures, and that I should sit next but two to the Queen at table, I should, in spite of my lively imagination, have thought him a fool, and laughed in his face." Of his humdrum life as a Professor of Oriental Languages in Budapest, and of his success as a litterateur and quasi-diplomatist, we have no space to write, but we refer the reader to these volumes, which are replete with interest and amusement. Underlying the whole work we seem to note two strains of thought; the one is disappointment and anger, and even contempt, of his own countrymen in Hungary, who as a nation have not shown that admiration and appreciation of the Professor's work which he anticipated and very justly expected; the other is the well-founded satisfaction that, however little he has been appreciated by his compatriots, he has earned and secured the admiration and applause of the rest of Europe, and especially of the Anglo-Saxon race throughout the world, and that he has in his day and generation exercised a wise and powerful influence in the politics of Europe and Asia. We hope that the evening of the venerable Professor's life may be unclouded and serene, and that these two remarkable volumes will not be the last to appear from his graphic and versatile pen.

The Face of the Earth. By EDUARD SUESS, translated by HERTHA B. C. SOLLAS, Ph.D., under the direction of Professor W. J. SOLLAS. Vol. I. Oxford, at the Clarendon Press, 1904. Pp. 604. 25*s. net.*

The first volume of *Das Antlitz der Erde* was issued in 1885, the second in 1888, and the first half of the third in 1901. The importance of this masterly work has long been recognised by geologists—more especially by those who are interested in the discussion of the larger problems of the science. In 1897 a French translation of the first volume appeared, and was succeeded in 1900 by the issue of the second—the work of translation being under the supervision of M. E. de Margerie. This edition was largely annotated by M. de Margerie, who also included a considerable number of illustrations not in the original. Professor Sollas, on the other hand, has confined himself to giving us a faithful English version of the original, and has not ventured either to annotate the text or to add to the plates and figures, which the author thought sufficient for his purpose. We think the English editor has been well advised in the course he has followed. Doubtless our knowledge of the geological structure of the earth's crust has been considerably enlarged within the past twenty years, and here and there the descriptive parts of Suess's great work may appear somewhat antiquated. But, even if such portions were brought up to date, they would not affect the general conclusions arrived at by the author, and to crowd the pages with superfluous annotations (however interesting these may be) only confuses and irritates the reader.

The leading views set forth by Suess as to the origin of the larger features of the earth's surface have been much canvassed and discussed, but most of them have now found their way into text-books of geology. It would be too much to say, however, that they have all met with general acceptance. Probably few, if any geologists have now any doubt that our great mountain-chains owe their origin to lateral pressure, or, in other words, to horizontal movements of the earth's

crust, and that, as Suess maintains, their general trend-lines have been determined by certain older elements in the structure of the crust, which have checked and opposed the lateral movement. These trend-lines are usually arcs or curves—often violently bent curves of accommodation. The Alps, for example, extend towards the Carpathians in a concave curve, and avoid the Bohemian mass—which at the time the Alpine movement took place must have formed a rigid or unyielding buttress. There is not the same agreement, however, as to certain other views upheld by Dr. Suess. He sees no evidence of regional or continental uplift—the only movements of elevation that he recognises being those which result in the formation of mountain chains. It is difficult, indeed, to conceive how continental uplift can be effected, but many geologists nevertheless are of opinion that certain phenomena cannot be otherwise explained. According to Suess, all the larger features of the earth's surface are primarily due to subsidence and collapse of the crust. In these we read the history of the breaking up of the terrestrial globe. The process "doubtless began a long time ago, and the brevity of human life enables us to contemplate it without dismay. It is not only in the great mountain-ranges that the traces of this process are found. Great segments of the earth's crust have sunk hundreds, in some cases even thousands, of feet deep." If the crust could sustain itself like a free arch, then neither folding nor fracturing and collapse could take place, and the surface would appear as a fairly regular spheroid, everywhere covered by a continuous ocean. But the geological structure of the crust testifies to the fact that the latter has throughout all time accommodated itself to the slowly diminishing bulk of the cooling and contracting interior, buckling up in ridges and wrinkles in some places, in other places collapsing and sinking vertically. It is owing to these vast subsidences that continental areas have come into existence. Dry land has appeared simply because the waters have been withdrawn from its surface and collected together in the deep oceans. Continents are not proofs of elevation but of the irregular subsidence of the crust.

The appearance of an English translation of this monumental work is most welcome. Geologists and geographers in this country who may not yet have made its acquaintance have now their opportunity. Miss Sollas has done her work so admirably that we are seldom reminded of the fact that we are reading a translation. Some of the German technical terms for certain rock-structures might, we think, have been more happily rendered—the English equivalents given hardly suggesting what the structures are. A similar objection, however, as Professor Sollas could urge, might be brought against some of the German technical terms themselves. After all, perhaps, it matters little what a thing is called, provided the name chosen does not suggest something totally different, and is sufficiently euphonious.

This is a notable addition to the series of standard works which have issued from the Clarendon Press, and it will doubtless be as favourably received as any of its successful predecessors.

Sociological Papers. By Francis Galton, G. Westermarck, P. Geddes, G. Durkheim, Harold Mann, and V. V. Branford. With an Introductory Address by James Bryce. Published for the Sociological Society. London: Macmillan and Co. 1905.

This volume contains the papers read before the Sociological Society in its first session, together with reports of the discussions which took place. Only a few of the papers can be said to have any direct bearing on geography. In a

paper on "Civics as Applied Sociology," Professor Patrick Geddes follows out much the same train of thought as in his recent book on Dunfermline. Dr. Westermarck contributes a short paper on the "Position of Women in Early Civilisation." Incomparably the most interesting of the papers is, however, one by Mr. P. H. Mann on "Life in an Agricultural Village in England." This is a study, of the same nature as those conducted by Mr. Booth in London, and Mr. Rowntree in York, of the economic condition of the working-class population of an English agricultural village, and is all the more impressive for being written from the impassive scientific standpoint. The picture which its figures give of the condition of the agricultural labourer in a village where the average weekly rate of wages is 13s. 7½d. for an adult man in full work, can only be described as appalling. Many persons maintain that the great cure for present-day evils is the return of the population to the land, but, as Mr. Mann points out, life on the land has for the agricultural labourer at least few charms. Let him work continuously from youth to old age, and practise all the virtues, there is yet every probability that as soon as he has *two* children he will sink below the primary poverty line. If there are more than two children, hopeless poverty must be the fate of the household until the elder children are capable of earning money.

Hazell's Annual for 1905: *A Cyclopædic Record of Men and Topics of the Day.* Revised to December 31, 1904. Edited by W. Palmer, B.A. London: Hazell, Watson, and Viney. *Price* 3*s.* 6*d.*

We have received the new issue of the above Annual, which, so far as we have tested it, seems to be on the whole well up to date, and contains as usual a very large amount of information arranged in a very convenient form. Under the heading of Geographical Progress, 1904, we find a concise account of the chief events of interest in the geographical world during the period in question, though in some respects, as in regard to the Mylius-Erichsen Expedition, not quite up to date, for Mr. Mylius-Erichsen, as already explained in these pages, returned to Europe in May last, and the rest of the party at the beginning of November.

With reference to the review of Murray's *Switzerland* on page 661 of this *Magazine* for December last, Mr. Stanford requests us to state that, having taken over the copyright of these guides, including the map-plates, and having revised and printed the latter in his own establishment, he considers himself entitled to add his own imprint.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

Lahore to Yarkand. Incidents of the Route and Natural History of the Countries traversed by the Expedition of 1870 under T. D. Forsyth, C.B. By George Henderson, M.D., F.L.S., F.R.G.S., and Allan O. Hume, C.B., F.Z.S. Demy 8vo, xiv. + 370. London: L. Reeve and Co., 1873.

Spain and its People: a Record of Recent Travel. From the French of Eugene Poitou. Demy 8vo. Pp. xii + 497. London: T. Nelson and Sons, 1873.

(*Presented by Miss Wilson.*)

Scandinavia. A Political History of Denmark, Norway and Sweden from 1513 to 1900. By R. Nisbet Bain. Crown 8vo. Cloth. Pp. viii. + 460 and five Maps. *Price* 7*s.* 6*d.* London: Cambridge University Press, 1905.

Also the following Reports, etc :—

Hazell's Annual for 1905. A Cyclopædic Record of Men and Topics of the Day. Pp. 756. *Price* 3*s.* 6*d.* London: Hazell, Watson, and Viney, Ltd., 1905.

Report on the Administration of Burma for the Year 1903-4. Rangoon, 1905.

A Plea for the Historical Teaching of History. An irregular Lecture delivered on November 9, 1904, by C. H. Firth, M.A. Pp. 30. *Price* 1*s.* Oxford: Clarendon Press, 1904.

District Gazetteer of the United Provinces of Agra and Oudh. Compiled and edited by H. R. Nevill, I.C.S. Volumes iii., iv., v., xxxvi., xxxviii., xlv., and xlvi. Allahabad, 1903.

Report of the Librarian of Congress for the Fiscal Year ending June 30, 1903. Washington, 1903.

History of the Library of Congress. Volume i., 1800-64. By William Dawson Johnston. Washington, 1904.

The Culture of Tobacco. By George M. Odlum. Pp. viii + 186. London: British South Africa Co., 1905.

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st December 1904 :—One-inch Map (third edition, engraved, in outline).—Sheets 15, 31. Price 1s. 9d. each.

Six-inch Maps (Revised) Quarter Sheets, Heliozincographed, with Contours (Price 1s. each.) *Aberdeenshire.*—1 SW. ; 4 NE. ; 10 SE. ; 18 NW. ; 18 SE. *Banffshire.*—3 NW., 3 NE., 3 SE. ; 4 NW., 4 SW. ; 5 SW., 5 SE. ; 6 SW. ; 9 NE., 9 SE. ; 10 NW., 10 NE. ; 15 NE., 15 SE. ; 16 NE., 16 SE. ; 22 NW. ; 22 SE. ; 31 SE.

Parish Maps (1:2500 Scale, Revised, with Houses ruled, and with Areas. Price 3s. each. *Banffshire.*—Sheets xiv. 3, 6, 7, 11, 15, 16 ; xv. 13 ; xix. 6, 7, 10, 11, 12, 14, 15, 16 ; xx. 3, 6, 10 ; xxiv. 15, 16 ; xxv. 2, 3, 6, 7, 10, 11, 13, 14, 15 ; xxx. 3, 4. *Inverness-shire.*—Sheets i. 1, 13 ; iv. 4 ; v. 1 ; xii. 2, 5, 6.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 2nd to 31st January 1905 :—Six-inch Maps (Revised) Quarter Sheets, Heliozincographed, with Contours. Price 1s. each. *Aberdeenshire.*—18 NE. *Banffshire.*—(4 NE. and 4 SE.) ; 8 NE. ; 10 SW. ; 16 NW. ; 16 SW. ; 22 NE. ; 31 NW., 31 NE. Without Contours. *Aberdeenshire.*—33A NE. *Banffshire.*—31 SW.

1 : 2500 Scale Maps (Revised) with Houses ruled, and with Areas. Price 3s. each. *Banffshire.*—Sheets xiii. 16 ; xiv. 10, 13 ; xix. 4, 8 ; xx. 1, 2, 5 ; xxiv. 9, 10 ; xxix. 3. *Inverness-shire.*—Sheets i. 5 ; xii. 1.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

GEOLOGICAL SURVEY OF SCOTLAND.—The following publications were issued from 2nd to 31st January 1905 :—

One-inch Map.—Sheet 70 (West Central Skye with Soay) ; Price 6s. Sheet Memoirs.—West Central Skye with Soay. The Geology of. (Explanation of Sheet 70.) By C. T. Clough, M.A., F.G.S. (the Description of Soay and Soay Sound) ; and Alfred Harker, M.A., F.R.S. (the Description of Part of the Mainland of Skye). 1904. Price 1s.

UNITED KINGDOM.—General Memoirs. A Handbook to a Collection of the Minerals of the British Islands, mostly selected from the Ludlam Collection, in the Museum of Practical Geology, Jermyn Street, London, S.W., by F. W. Rudler, I.S.O., F.G.S., late Curator of the Museum. 1905. Price 1s.

EUROPE AND THE MEDITERRANEAN.—Bartholomew's New Railway and Steamship Route Map, specially designed for Travellers. Scale 86 miles to an inch. Price 1s. or 2s. mounted on cloth.

John Bartholomew and Co., Edinburgh.

ALDERSHOT DISTRICT.—New Military Map by J. Bartholomew, F.R.G.S. Scale 2 miles to an inch. Price 2s. mounted on cloth.

John Bartholomew and Co., Edinburgh.

AFRICA.

AFRICA.—War Office Map on scale of 1 : 1,000,000 or about 16 miles to an inch. District Sheet 71, Monrovia. 1905. Price 2s.

Intelligence Division, War Office, London.

BRITISH CENTRAL AFRICA.—War Office Map on Scale 1 : 250,000 or about 4 miles to an inch. 1904. District Sheets—105G, Songwe River ; 105K, Nyika Plateau. Price 1s. 6d. each Sheet.

Intelligence Division, War Office, London.

EGYPTIAN SUDAN.—War Office Map on Scale of 1 : 250,000 or about 4 miles to an inch. 1904. District Sheets—66M, Hillet Nuer ; 78A, Ghaba Shamba. Price 1s. 6d. each sheet. *Intelligence Division, War Office, London.*

ASIA.

KHOTAN.—Map showing Portions of the Territory of Khotan and adjoining Regions, surveyed under the direction, and with the assistance, of M. A. Stein, Ph.D., by Sub-Surveyor Ram Singh, R.S. 1900-1901. Scale 1 : 506,880 or 8 miles to an inch.

Presented with Dr. Stein's compliments. Survey of India Department, Calcutta.

This map accompanies the "Detailed Report" on Dr. Stein's explorations in Chinese Turkestan, 1900-1901.

GENERAL.

GROSSER DEUTSCHER KOLONIAL ATLAS.—Bearbeitet von Paul Sprigade und Max Moisel. Herausgegeben von der Kolonial-Abteilung des auswärtigen Amts. Lieferung 4, Deutsch-Ost-Africa, Nr. 20, 23. Die Deutschen Besitzungen, im Stillen Ocean und Kiautschou, Nr. 25. 1904. Price 3 M. or 1 M. per sheet. *Dietrich Reimer (Ernest Vohsen), Berlin.*

TRACK CHART OF THE WORLD.—Compiled by Captain James Tait, Nautical Academy, Glasgow, showing Currents, Ice, Fog, etc.

James Brown and Son, Glasgow.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE SIKHIM HIMALAYA[1]

By Douglas W. Freshfield.

The first and the most abiding impression made on the newcomer from India on his arrival at Darjeeling is that he has entered another country, almost another quarter of the globe: he recognises that he has changed not only sky and landscape, but architecture, people, and religion. Broad-framed, wide-faced, thickly-clad, laughing Tartars, a trifle "smouchy," to adopt Charles Lamb's epithet, take the place of the slender, thinly-clad, melancholy Bengalees: Buddhist temples and chortens and prayer-flags have supplanted the village shrines. Instead of vast alluvial plains he finds himself perched on and surrounded by ridges and slopes on which there is hardly level enough to build a house. And as to scenery; I have already added one to the too numerous descriptions of the indescribable splendours of the view from Darjeeling, when, in the sunset glow, Kangchenjunga raises its majestic brow, like a lone beacon-light from another world, above the hundred folds of the foothills and the stark crests of the lesser snows. You need not fear I shall repeat the vain attempt to-day. I propose to do better; to illustrate the scenery of Sikhim by showing you a series of photographic views mostly taken by my companion, Signor Vittorio Sella.

I must first ask your attention for a brief description of the geography of Sikhim, of the district that, owing chiefly to political accident, is the main southern gate to Tibet. The facts I shall lay before you have little or no claim to be novel, but since they have been somewhat obscured lately in the crooked vision of partisans, it may be no waste of time to restate them. In the imagination of some of our critics Tibet looms large as a sort of Caliban's island, "desert, uninhabitable, almost inacces-

[1] An address delivered before the Society on 22nd February.

sible." It has been alleged that Tibet is remote—that the whole country is practically a frostbound desert, untraversable by an army, and never traversed by one—that its inhabitants are as fierce and fanatical as Afghans, and ought to be approached with the same precaution—that the region is beyond the political influence of Russia, has not lately been the scene of Russian intrigues, and could never become a path for Russian aggression. These are, I think, fair specimens of the statements that were put before the public during the early stages of the recent expedition.

Let me briefly examine some of these statements. The present frontier of Tibet, the point from which in 1888 the Tibetans invaded British territory, is about 350 miles from Calcutta—nearer, that is, by some 200 miles to the seat of government than the Russian post at Penjdeh is to Peshawar. From the Tibetan frontier Lhasa is (according to the Sikhim Roadbook) about 250 miles by a route which presents no serious physical obstacles to commerce during many months of the year.

The possibility of moving an army across the Eastern Himalaya into India has been proved. In 1792 the Chinese sent an army of 60,000 men into Tibet, and marched down to within fifteen miles of Katmandu, the capital of Nepal, where they fought a battle which resulted in the submission of the Nepalese, thus proving the penetrability of the Eastern Himalaya to a large force. Katmandu, of course, is short of the plains of India, but it is as much across the Himalaya as Domo D'Ossola is across the Alps. What the Chinese did once they might easily do again should China ever become a vassal state of Russia. This fact disposes of what a German writer calls Sven Hedin's "exceedingly warm and passionate argument against the British advance on Lhasa."

Next as to Tibet being a desert. This is a generalisation that has perhaps been formed from bird's-eye views of the uplifted region on the Sikhim frontier, coupled with the narratives of the travellers, Sven Hedin, Littledale, and others who have crossed the deserts of northern Tibet in their anxiety to escape notice while looking for a backdoor to Lhasa. On first view, it is true, the traveller who has found his way through the mazes of the foothills and up the gorges of Sikhim to the top of the long staircase that leads from the plains of India to Tibet is struck by the apparent barrenness of his surroundings. He sees extensive, almost level plains, treeless, and clad only in parts with sparse brown herbage, girt and divided by low ridges. Icy peaks fringe the horizon. In the absence of definite valleys, sluggish streams meander aimlessly across the wide landscape between tawny slopes and beds of sky-blue gentians. It is an open country. The only signs of life are the summer stations of the herdsmen, or rare villages overlooked by the high white walls and flag-capped parapets of monastic fortresses. But this is only the rim or rind of Tibet, and even in this rind there are soft spots. Thus Major O'Connor writes (July 18th, 1903):—"Major Bretherton made this morning a reconnaissance towards the south-west, and found a rich and fertile valley some three to four miles from Khamba Jong, where grazing is abundant, and where barley crops are raised and cattle are reared."

A few marches more and the traveller reaches the cultivated region

leading to the valley of the Brahmaputra, to which the above description equally applies, as appears from an official report. I understand that the valley of the Brahmaputra from Lhasa westwards has been found by the recent Mission to be for a long distance well inhabited and cultivated. The valley of the Brahmaputra is the real Tibet. Generalisations framed from visits to the southern frontier are like descriptions of England founded on glimpses of the Scottish Borders.

The Tibetans are very far from resembling the fanatical Afghans. They are not a warlike people and have never proved themselves formidable. "They are a pastoral people and a trading people, and their religion is a tolerant one," writes Hooker's companion Dr. Campbell "Until 1783" (until, that is, China had asserted her supremacy), he adds, "the Tibetans were friendly to trade with us."

It would be superfluous, I believe, after what is known to have occurred, after the visits of the Lamas to Livadia and St. Petersburg and the flight of the Dalai Lama with his Russian adviser into the Czar's dominions, to deny that Russia has had relations with Tibet.

Having, I hope, cleared the ground of these misapprehensions, I will proceed to a more detailed description of Sikhim as the Gate of Tibet. The political state of Sikhim, together with the districts of Darjeeling and Kalimpong (the latter once part of Bhutan), formally annexed to India, coincides at present with the basin of the Tista. From the Himalayan watershed (16,400 feet) to the plains that river runs for about 100 miles in a direct line (more, of course, following its meanders) through a rapidly deepening trench. It is fed by numerous tributaries flowing out of side glens which run up to the vast glaciers of Kangchenjunga on the west and to the lesser snows on the east. At first its trench is broad, but opposite Kangchenjunga (at 8000 feet) it suddenly drops and becomes a precipitous gorge, which, until the British had mended the track (which was before my visit in 1899), was often impassable for months even for coolies, and was never passable for beasts of burden. Lower down, the Tista runs in a deep valley through soft, billowy foothills, whose slopes are apt to slip away in the rains. This is the track by which I rode up to the back of Kangchenjunga, and this was the track by which we moved troops to Khamba Jong at the commencement of the late frontier troubles. The difficulties are similar to those of many a mule-track up an Italian Alpine valley; that is, nothing for travellers, but considerable for the impedimenta of an armed force. This route having, till a few years ago, been impracticable for any beast of burden, has never been the trade route to Tibet. That passes up the valley of the next stream parallel to the Tista on the east, the Ammo Chu. Owing to the lower reach of its valley lying in Bhutan, the middle course of the Ammo Chu was reached by crossing a pass either from Bhutan on the east or the Tista Valley on the west.

The passes from the west, about 14,000 feet high (of which the Jelep La, the Yak La, and the Cho La are the best known), are passes of the character of the mule-paths round Mont Blanc. Once in the Ammo Chu Valley, there is little further difficulty in climbing to the broad watershed at its head, and descending over the bleak uplands to Gyangtze.

This is the commercial travellers' track to Lhasa, and the late expedition reports that there is no serious difficulty for an unopposed force or caravan at any spot on the road.

The main point to realise is that Tibetan scenery begins, and Sikhim scenery ends, many miles south of the watershed, and at a height of 8000 to 10,000 feet. Below are V-shaped valleys, gorges, steep cliffs, dense tropical forests, a region formerly accessible only on foot; above are shallow troughs and bare rolling hills, "like Wiltshire Downs" (I borrow the expression from Major O'Connor). The one is a country modelled by water, the other a country modelled by ice. The destructive agent has dug deep furrows, the conservative agent has preserved the primeval smoothness of a land recently emerged from an ice age. Some of Professor Garwood's photographs of Spitsbergen remind me, in the surface outlines, of the country behind Kangchenjunga.

This configuration of the earth's surface has had naturally great influence on its population, and consequently on political boundaries. In Sikhim in the old days communications were strangely difficult; the hillsides slipping down in blocks under the perpetual rains, the torrents with their rope-bridges could only be crossed by sturdy pedestrians. But above the timber-line yaks, and even light carts in many places, travel easily. The Tibetans consequently used and occupied the upper pasture region south of the watershed, just as the Germans seized the heads of the valleys south of Monte Rosa. Their herds roamed over Lhonak and the sources of the Tista. They paid no respect to the opinion of geographers that a watershed is a proper political boundary. They preferred a cattle-shed; they practically extended Tibet to the point at which it became too hot for their yaks. Hooker was told he had reached "Cheen," at the Zemu bridge, a mile or two above Lachen.

In one southern valley, that of the Ammo Chu, the Tibetans fixed themselves. At Phari, at the very head of the dale, was an old Tibetan frontier fortress commanding the trade route to Lhasa. Lower down the valley a powerful monastery owned most of the land. The Bhutanese and Sikhimese monks quarrelled for possession of the monastery and (regardless of Æsop) called in the rulers of Lhasa as arbiters. The natural result followed.

In the occupation of Chumbi by Tibet we acquiesced even after the Tibetans had, in 1888, used it as a base from which to invade Sikhim. Yet it is only necessary to glance at a map to see that this wedge or tongue of Chumbi, lolled out Tibetan fashion at us across the watershed, is no part of Tibet proper. Nor are the inhabitants Tibetans; they are, as Mr. Candler has told us, a separate and oppressed race, who "were unaffectedly glad to see us in their valley." But up to to-day there is no sign that these obvious facts—which I was at pains to insist on in my book published in 1903—have been appreciated by our rulers, and I fear lest once more the indifference of statesmen in England to geographical knowledge may throw away the main advantages which should have been the legitimate fruit of the late expedition. The Chumbi Valley is all that Darjeeling is not. It furnishes a health station beyond

the first fury of the rains. It supplies an admirable strategic centre for the ward of the frontier, while Darjeeling is an isolated hilltop from which the first move involves a descent of over 6000 feet. Again, lying as it does on the great trade route, Chumbi has every advantage as a commercial mart and exchange. It is the very spot for "the annual fair or bazaar to be held for two months in the spring at some place near the frontier" recommended by Sir J. Hooker's companion, Dr. Campbell.

In keeping Chumbi we should not annex part of Tibet, but recover a territory to which it has no claim but that of occupation.

I have spoken of Chumbi's important position on a trade route, a route of little more than 300 miles from the plains to Lhasa. This route will shortly be made a cart track throughout, for leave has been got from the Bhutanese to make a road through their territory which will reach Chumbi without crossing the Jelep La or any high pass.

I must now turn to give a few particulars of my own journey, in which the complete tour of Kangchenjunga was made by Europeans for the first time. We had the services of Mr. Dover, the road inspector in Independent Sikhim, a most energetic officer, who took on himself the management of our very mixed troop of over fifty Bhootia, Lepcha, and Nepalese coolies, or porters; of Angelo Maquignaz of Breil in the Vallée d'Aoste; and of Rinsing Khazi, one of the—more or less—trained explorers of the Indian Survey, who had himself made the same journey some years before.

Our object was to link the recent routes of Mr. White, the Political Resident in Independent Sikhim, east of Kangchenjunga, with those of Sir Joseph Hooker in Nepal on the other side of the mountain in 1848. To effect this it was necessary to traverse the region left a blank in Hooker's map with the superscription: "This country is said to present a very elevated rugged tract of lofty mountains, sparingly snowed, uninhabitable by man or domestic animals." Its delineation in the existing Government Survey maps is, at least as far as the Nepalese territory is concerned, based rather on the imaginations than on the observations of native explorers.

On September 5, 1899, my party left Darjeeling by the pony road, which has been lately made practicable through Kalimpong, Gantok, the new residence of the Sikhim Raja, and the Upper Tista Valley to Gyagong on the Tibetan frontier, near the foot of the Donkia and Kongralama Passes. This track, a series of alternate ascents and descents, some of no less than 6000 feet, passes through what must surely be the most romantic woodland scenery in the world. The tall trunks of the forest giants are ringed with orchids and festooned with creepers, the ground is carpeted with blossom even in autumn, and the full streams tumble between banks of luxuriant ferns. Above all, whenever the white mists part, shine the still whiter snows of Kangchenjunga and its attendant peaks, poised at an incredible height in the fields of air.

Beyond the junction of the Lachen and Lachung torrents, the landscape and the vegetation become more alpine; rhododendron-trees,

pines, and larches take the place of oaks, magnolias, and bamboos. At the village of Lachen (8800 feet) the novel portion of the journey was entered on. The first problem was to force a way up the wooded defile of the Zemu, which Hooker fifty years before had found impassable, to the great eastern glacier of Kangchenjunga. Some Goorkha pioneers were sent ahead to cut a path through the dripping rhododendron jungle. After wading and scrambling through bogs and bushes for two days under constant showers, we gained more open ground near the foot of the ice. After three more days of slow progress across and beside the glacier, which is about seventeen miles in length, we came on a good camping-place within four hours' walk of the very foot of the vast curtain of cliffs and buttresses, which bears up the crest of Kangchenjunga on the north-east. This spot had already been visited by Messrs. White and Hofmann, who gained it by a pass which gives access from the south to the foot of the glacier.

Here our party was overtaken by the storm which wrought such havoc at Darjeeling. At this elevation (over 15,000 feet), it assumed the shape of a snowfall, which lasted forty hours and lowered the snow-level more than 3000 feet. The whole country above 14,000 feet was laid under a continuous mantle of fresh snow about a metre deep where it had not drifted. There was nothing for it but to dig out and pack up the more than half-buried tents, and to abandon the idea of an attempt to reach any of the peaks that surround Kangchenjunga, or of the gaps between them. Even to retrace the march to the lower camp became an almost intolerable labour, when blazing and blinding sunshine, of a quality unknown in the Alps, intensified the toil of trampling a track through the new snow.

As some compensation for this ill-luck we were favoured during the next four weeks by fine and clear weather only once interrupted for three days. We saw to perfection the great peaks round the Zemu glacier. Of these the most beautiful—perhaps the most beautiful snow mountain in the world—is Siniolchum,[1] the D^2 of the Survey (22,570 feet). Its icy cliffs are exquisitely fluted, the snow upon its crests is blown up into fantastic fringes, so thin as to be transparent to the sunshine. It is the embodiment of the Inaccessible, a fitting throne for the Spirit of the Summits.

Under the new conditions created by the great snowfall it was uncertain whether it would be possible to continue the journey. In ordinary autumns the two yak-passes (both over 16,000 feet) that lead to the Lungma Chu, the westernmost source of the Tista, are as easy as the Wengern Alp at the same season. Now they were like the Wengern Alp in February. Despite the tents, rugs, warm boots, and spectacles with which the coolies had been provided, many of them, chiefly through their own heedlessness, suffered from sore eyes or frostbitten feet, while others shammed. Thanks, however, to Mr. Dover, they were kept together, with the exception of a few invalids, who were sent back.

After much wandering and wallowing over the two passes the

[1] Cf. this *Magazine*, xx. p. 144.

desolate valley of Lhonak (15,000 to 17,000 feet above the sea-level) was reached. Its stream flows sluggishly through a wide bare basin; the gentle outlines of the lower hillsides are obviously due to their long protection by ice from the destructive agencies of air and water, the rapid alternations of heat and frost, that have been at work on the highest peaks and in the deeper valleys. The empty beds of ancient ice lie just as they were left by extinct glaciers, whose shrunken survivors cling round the base of ranges 19,000 to 24,000 feet in height, yet hardly more impressive than the peaks of the Engadine. There are no trees, no shrubs bigger than the stunted junipers that just suffice for firewood, grass grows sparely, the surface of the earth is brown and yellow, except where the larger gentian, Eton, instead of, as in the Alps, Harrow blue, makes little patches of colour, or scattered pools of water reflect the deeper tones of a Tibetan sky.

This district is cut off from the lower habitable world to the south by wellnigh impassable ravines and torrents; it is more easily accessible from Tibet by two relatively low passes. In our treaties with the Chinese Government it is recognised as part of Sikhim; but, since its scanty herbage attracts a few herds of yaks and their shepherds from the north, claims were up to 1904 put forward to it by the rulers of Lhasa.

Our party camped for two nights on the snows near the head of this valley. On the intervening day a ridge to the north, erroneously stated by Rinsing to be the Chortenima Pass, was climbed, and panoramas secured of a white wilderness crowned by many noble and nameless summits. On the opposite, or southern side of Lhonak—not at its extreme head as shown in maps—rose the great slopes of the Jonsong La (20,350 feet), which crosses the ridge linking Kangchenjunga to the Tibetan Highlands, and dividing Sikhim from Nepal.

It cost the coolies three days of arduous toil to reach the crest. The snow was still in detestable condition. The final ridge is steep on both sides. But there is nothing that an Alpine climber can fairly call a difficulty. The native point of view is naturally different. In a memorandum on his own services prepared by the Bhootia surveyor Rinsing, he described this pass as "The Jaws of Death"! He himself gave us our worst moment by asserting as we reached the top that he had missed the way and that we must go back. His excuse was that the narrow gap through which the Nepalese glacier escapes was completely hidden, the great mass of Kangchenjunga and Jannu appearing to be joined by a continuous wall with the ranges due west of the pass.

The only descent lay down a narrow trough, filled by *névé* that turned gradually to glacier ice, and hemmed in by abrupt ranges. The surface was very little crevassed, so that a rope was never needed. But it was broken up, like a sand pit, into heights and hollows. It took two days of very rough travel to cover a distance of some ten miles, from a bivouac at a height of over 20,000 feet close to the pass, to the first grass and firewood. This was found at the angle where four or five glaciers, pouring down from the hitherto unknown NW. flank of Kangchenjunga, join the main ice-stream. On all its other sides the

The Valley of Kangbachen in Nepal, looking towards Khunza.

great mountain shows broad tiers of precipices. Here a *névé* ladder runs up between rock buttresses to a snow plateau lying immediately under the highest peak. Some of the steps in this ladder are steep, and one of them must always be exposed to falls from an overhanging glacier. If this danger can be avoided, or proves less serious than it appears at first sight, there may be here a practicable route to the top.

From this camp the view of the snowy range is of extraordinary grandeur. There can be few spots, even in the Himalaya, where such a ring of peaks, many over 24,000 feet, is visible at once and close at hand. A gap was recognised over which, but for the snowfall, a direct pass might have been forced to the Zemu glacier. Our route followed first the Nepalese glacier for about eight miles and then the river flowing from it, a tributary of the Arun, passing under the marvellously precipitous cliffs of Jannu, which was itself well seen. Three very easy marches brought us to the large Nepalese village, described by Sir J. Hooker as Kangbachen, the name of the district, but generally known as Hunza or Khunza. Here, twenty-four days after leaving Lachen, inhabitants were again found. Despite the forebodings of some of our party the Nepalese here proved friendly, and a certain amount of fresh provisions was obtained without any serious difficulty.

The remainder of the narrative must be cut short. The journey was completed by traversing first three or four ridges of about 15,000 feet (from one of which the 29,002 feet summit designated as Mount Everest was well seen, with a great rock-peak behind it) to the Tseram Valley, and then the Kangla, 16,740 feet, to Jongri, the future Riffelalp of Sikhim. Thence an excursion was made to the Guicha La (16,430 feet), the gap due south of Kangchenjunga, between Kabru and Pandim, which had been visited previously by several travellers. The return to Darjeeling was made by way of the famous Buddhist monasteries of Dubdi and Pamionchi. The whole tour occupied seven weeks, during which some 75,000 feet, or fourteen miles of vertical height, must have been climbed and descended.

The journey was not without substantial results. Amongst these is the collection of several hundred views of flowers and forests, peaks and passes, and also people, taken by Signor V. Sella and Professor Garwood at heights varying from 700 to 20,500 feet, I have shown specimens of. Mr. Garwood also obtained material for a sketch-map of the Kangchenjunga group. He brought home considerable collections of geological specimens, moths, and butterflies. His collections would have been more complete had not the servants of the Peninsular and Oriental Company dropped one of his packages into the water in the London Docks and then, according to their own confession, "overhauled the contents and dried them thoroughly in a laundry."

On another matter of scientific inquiry observations of some interest may be recorded. Volumes have been already written on the effects on the human frame of high altitudes. Although greater elevations have been reached by climbers, both in the Himalaya and the Andes, it is probable that on no previous occasion has so large a collection of human beings carried so much weight or slept above 20,000 feet.

The following is a summary of our party's experiences: mountain sickness was felt more about 15,000 to 16,000 feet than 5000 feet higher, and it was felt very unequally by individuals; the majority of the party suffered from feelings of lassitude and fatigue after slight exertion, some were for a time entirely prostrated, and one coolie died; others on the contrary were throughout entirely exempt from any perceptible inconvenience. Amongst these were a Goorkha, who *ran* back over the 20,000 feet pass to bring on loiterers, and Mr. Dover, who suffered only from an increased appetite and gained several pounds in weight during the journey. It is possible that the intense glare and heat on the new-fallen snow had much to do with the sickness of some of the party on first reaching 15,000 feet.

THE ECONOMIC EXPANSION OF THE CONGO FREE STATE.

By Ch. Sarolea, D.Ph., D.Litt., F.R.S.E., of Edinburgh University, Consul for the Congo Free State.

(*With Maps and Illustrations.*)

In the month of February 1905 it was exactly twenty years since the Conference of Berlin put the coping-stone to the great work achieved by King Leopold in the heart of Africa; it was twenty years since the Powers of Europe placed under the guarantee of an international treaty and of solemn international obligations the independence of that young State which had been previously created by the bold initiative and enterprise of the Belgian ruler, and by the devotion and heroism of his subjects and collaborators.

When one thinks of all that has been attempted and accomplished during this comparatively short period of twenty years, and of the marvellous changes that have been brought about, one is inclined to view the history of the Congo as the romance of modern colonisation: for indeed many of the stirring incidents that have marked its annals have been as extraordinary as any chronicled in any masterpiece of fiction.

I.

To realise vividly the advance that has been made, one has only to consider for one moment the series of maps which have been prepared for the present article by Mr. J. Bartholomew, and to compare these maps with those that appeared in the early eighties, maps where the vast area covered by the new State was only indicated by a blank—a terra incognita; and where it was left to the imagination of the reader to fill this blank with tales of terror about the deadly equatorial forest, about the barbarities of pigmy and cannibal populations, and the atrocities of the Arab slave-traders and slave-raiders.

We have just called the Congo the "romance" of colonisation. This is not the place, in a scientific journal, nor is it to our present purpose,

to examine whether, even as in the romance of fiction, the noble and daring deeds of heroes have not been marred by the deeds of wicked men. We cannot enter into the controversy which has recently brought the Congo Free State prominently and unpleasantly before the eye of the British public. We have only to deal here with the geographical conditions and economic possibilities of the Congo Free State. And, leaving aside the humanitarian aspect, there can be no doubt that, looking at the Congo State merely from the economic and political point of view, its history has been a wonderful tale of continuous expansion and progress.

The Sirdar visiting Inspector Hanolet at Lado.

In 1885 there practically existed no trade—at least no legitimate trade. The only trade that did exist was an illegitimate one: namely, a trade in arms and ammunition, in slaves and liquor. The bottle of gin had become the only currency on the Lower Congo, as it still is in some parts of the British West African Coast. Slaves were the chief means of transport. Indeed it seemed as if commerce, by means of the sale of poisonous spirits, only existed to degrade the natives, and by means of arms and ammunition only existed to supply the Arabs with the necessary instruments to terrorise them. In one word, private trade, instead of being the ally and auxiliary of civilisation and colonisation, had become its deadly enemy.

Governor-General Baron Wahis.

It was no wonder that no honest traders could be tempted to venture into the interior. Before reaching the Upper Congo they would have had to traverse one of the most desolate and deadly regions of Africa, the insuperable barrier of the Crystal Mountains, which nature seemed to have interposed to defend the approach of the mysterious continent. And when the traveller arrived at Stanley Pool, ill and exhausted, after a weary march

of thirty days under the tropical sun, along a path strewn with the corpses of hundreds of native porters, he would only be at the beginning of his difficulties. For if he would proceed further, he would have to clear his way with the axe through dense, impenetrable forest and fever-breeding swamps, or he would have to fight his way through savage and cannibal tribes, whom the Arabs had taught to look with hatred and terror upon any human being with a white skin.

Such was the Congo in 1885: truly the "darkest part of dark Africa," a blank on the map, a nightmare in the imagination of men, a zoological garden, a human shambles.

Major Gibbons and the Lemaire Expedition at Lukafu.

What is it now in 1905? In 1905 the weary march along the route of the cataracts, which extended over thirty deadly days, and which foreboded only too fittingly all the horrors of the Upper Congo, is replaced by a railway journey of twenty-four to thirty-six hours. And beyond Stanley Pool an ever-increasing fleet of steamers carries civilisation into the darkest corners of the Dark Continent. The accursed slave trade has gone, and gone for ever. The gin trade has been suppressed, as well as the trade in arms and ammunition. Hundreds of political and missionary stations, of churches, hospitals, schools, laboratories, have been established. Vast tracts in the impenetrable equatorial forest have been cleared, and luxuriant plantations and smiling gardens have taken their place. Such is the security and peace which is already enjoyed over 1,000,000 square

miles under the Congo flag, that independent and solitary travellers, including ladies, have been able to travel from one end of the Congo to another "with no protection but an umbrella." Such is the security enjoyed that we already see enterprising travelling agencies organising tourist expeditions in the cannibal and pigmy country of Cameron and Stanley.

That trade follows the flag is one of the most doubtful and most controverted commonplaces and aphorisms in colonial economics. But there is one sense in which the aphorism is an undoubted truth. Trade—we mean legitimate trade—can only follow, it never precedes, the flag of a civilised government. Until that flag is established and respected, as long as government has not guaranteed order and peace, trade on any

White Staff at Stanleyville.

large scale is impossible. And therefore it is strictly true that in a tropical colony economic development is subordinate to political development. And of no colony has that been more especially true than of the Congo. When we consider the frightful obstacles in the way of Congo colonisation—a deadly climate, a huge continent in a permanent state of warfare, the most degraded native cannibal races, slaughtering and mutilating and eating each other, the impenetrable tropical forest, the vast distances, the absence of ways of communication, the scarcity of the white population, the reluctance of capitalists to invest their money in such a speculative enterprise—when we consider all these accumulated obstacles, it is quite obvious that no private efforts or resources could ever have developed the heart of the Dark Continent. It required the strong hand and the iron will of a great ruler, it required a systematic policy, to establish a settled order of things in the Congo regions, and

to develop their wealth. This exactly was the self-appointed task of King Leopold and of the self-made and self-supporting Free State. And until that task was accomplished there was not, there could be no protection for missionary enterprise, there could be no prospect for any expansion of trade.

But whilst it is strictly true that in the Congo trade could only follow the flag of a settled and strong government and could not precede it, it is no less true that trade could only follow along the lines of communication, and that no real trade could be done until such lines of communication were established. The Congo River with its tributaries is one of the noblest highways of commerce in the world, providing from ten to fifteen thousand miles of continuous navigation, and the heart of the

Commissaire Royal Malfeyt and his Officers.

Dark Continent is almost as much the creation of this river as Egypt is the creation of the Nile; unfortunately, its lower course for a distance of 200 miles is impeded by an impassable barrier of rocks and cataracts. Until this obstacle could be turned, until a railway could be built connecting the Lower with the Upper Congo, the interior would be inaccessible to European enterprise. Every writer has repeated the famous words of Stanley that without such a railway the Congo Free State was not worth a two-shilling piece, but that with such a railway there would be opened to commerce one of the richest regions on this planet.

The prophecy of Stanley has been amply verified. Not only has the building of the railway and the launching of a fleet of steamers, together with the establishment of a strong government, opened to trade every part of the Congo Free State, but it has even partly diverted the trade of the whole of Central Africa. Until 1895 the historical trade route of

Central Africa was from Lake Tanganyika to Zanzibar, and it was probably the economic importance of this trade route which decided Germany to take for her share in the partition of Africa the East African territories. Unfortunately for Germany, the development of the Congo Free State has considerably, if not entirely, reduced the commercial value of her African Empire, and the State has diverted her trade as well as the trade of the Sudan and of Northern Rhodesia. This will be more and more the case as the Congo Free State carries out its far-reaching railway schemes. The project of a Central Trans-African railway is being rapidly matured, and has been practically decided, and will directly connect the rich mineral regions of Katanga with the Lower Congo. And the time is not far distant when on the banks of Tanganyika there will arise a great tropical city, the successor of the Nyangwe and Kasongo of the Arab slave-traders, which will be to the Lake district of Central Africa what Chicago has become to the Lake district of the United States, namely, the predestined emporium of commerce, the converging point of all lines of communication.

A View on the Railway.

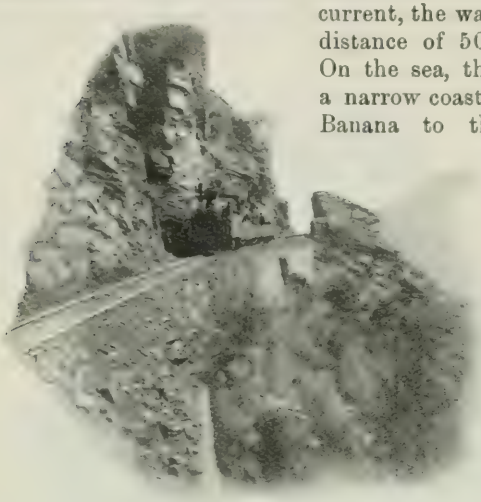
II.

For indeed the economic possibilities of the Congo are enormous, and an extraordinary variety of soil and climate and geographical conditions makes it produce every variety of natural wealth.

Geographically the Congo Empire, which extends from 12° longitude E. to 31° and from 5° latitude N. to 13° latitude S., may be divided into five parts.

1. The Estuary and Lower Congo. Emerging from the Crystal Mountains, where a long succession of thirty-two rapids, called the Livingstone Falls, has made its course unnavigable, the Lower Congo

below Matadi has a width of about 1000 metres, which extends to 13,000 when the majestic river reaches the sea at Boma in a formidable current, the waters of which are seen at a distance of 50 kilometres into the ocean. On the sea, the Free Congo State has only a narrow coast-line of 35 kilometres, from Banana to the Portuguese frontier of Kabinda.



View of Railway.

2. The belt of mountains which encircle the whole of Central Africa like a colossal girdle. It is this barrier which the Congo River has to break through, forming in the Crystal Mountains (700 - 800 metres) some of the grandest cataracts and some of the finest scenery in the world. And it is this obstacle which the Congo railway has had to turn, along one of the most deadly and most desolate regions of Africa.

3. The valley of the Congo River and its mighty tributaries, the Ubangi-Uelle, the Kassaï, the Lomami, the Aruwimi, each of which forms a river system by itself, constituting a network of tens of thousands of miles in length, and forming the vast Congo swamps and dense tropical forests, with their rubber vines and vegetable wealth.

A Bridge on the Old Caravan Route.

4. A high plateau land, rising gradually above the river system, and constituting, in the Kassaï and Katanga and many other districts, fertile and healthy territories adapted for European colonisation.

5. The mountainous Alpine range of the Katanga in the south, which divides the hydrography of the Congo from the basin of the Zambesi, and which, with its copper and gold mines, constitutes one of the richest mineral repositories of the planet; the chain of the Mitumba

mountains in the east, along the great Central African rift formed by the succession of lakes from the Lake Moero to the Upper Nile; the massif of the Ruwenzori, which reaches an altitude of from 3500 to 5500 metres; the plateau of the Niam-Niam in the north-east (average altitude 700-800 metres).

Such being the natural divisions of the Equatorial Congo Empire, it would be more easy to say what those vast regions do *not* produce, than to enumerate what they do produce. It is true that hitherto only two commodities have formed the staple exports of the State, namely, ivory and rubber; but the wealth of rubber which, under careful and provident State supervision, is seemingly inexhaustible, is a very fair indication of the vegetable wealth of the equatorial forest, and the very fact that the two staple articles alone have been sufficient to provide an annual export of over two millions sterling, enables us to realise the future and probable expansion of trade when all the other resources have been exploited, when the cotton plantations, which have been established after successful experiments, will have yielded their crops, when the plantations of coffee, cocoa, tobacco—together with palm oil, gum copal, and rare timber, of which there is an enormous supply—swell the export figures of the State. And it is impossible to forecast the future of the mineral exploitation in the south and south-east, when the gold and copper mines have verified the promises of the prospectors, and yielded part of their treasures.

III.

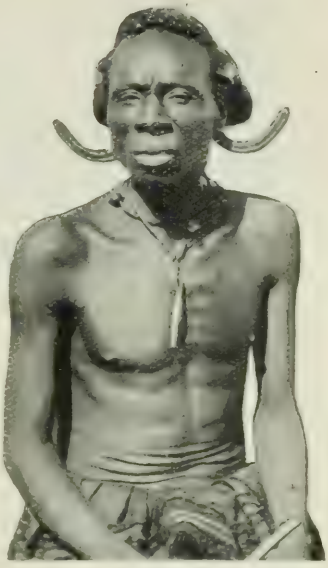
But the economic expansion of the Congo is conditional not only on the development of the means of communication, as well as on the development of the political and administrative machinery—which shall ensure even more fully the security of person and property—it is still more dependent on an adequate and continuous supply of native labour. And this supply itself is conditional on the raising of the material and moral wellbeing of the native population. And this raising of the native population is all the more indispensable and urgent, as a large proportion of its twenty millions belong to the most degraded tribes of a degraded race. It would be dangerous to generalise and to apply a sweeping statement to populations which are broken up into thousands of independent communities, and which have little in common, not even the colour of the skin. There are enormous differences, for instance, between the Nigritians and hybrid tribes of the Nile region and the Negrillos or Pygmies, between the Fulah-Azande of the Niam-Niam district and the Bantu races, which form the bulk of the population. And even with regard to the Bantus, there is little in common between the Bacongos of the Lower Congo, influenced by Portuguese and European traders, and the Manzemas of the east, influenced by the Arabs. Some tribes are cruel and warlike, like the Bangalas and Batetelas, others are peaceful and timid and industrious, like the gifted Bakubas of the Kassaï district. But speaking generally of the tribes of the richest regions of the equatorial forest with which the Europeans are likely in the future to have

the closest intercourse, there can be no doubt that, with their sensual and

Hatende, Chief of Jafunga Village.

brutal instincts, with their gross fetishism, with their monstrous tattooing practices, with their total inability to form abstract ideas, they

belong to the lowest scale of humanity. Indeed if it were not for two important redeeming features, a wonderful commercial instinct and an extraordinary capacity for imitation and assimilation, one might well ask oneself whether these populations will ever provide the raw material for civilisation. At any rate, to raise these tribes from their present condition will tax the utmost political capacity of the Belgian colonisers; it will require a rare combination of firmness and humanity, of patience and energy, of sympathy and tact. Nor is it necessary to approach the problem from the ideal point of view of the philanthropist: the simplest consideration of the conditions of economic and political success ought to suffice to indicate the right method of treating the natives.



A Baluba Chief.

A humane and humanitarian policy seems to us to be inseparably bound up with the commercial expansion of the Congo State. All the legislative measures and enactments seem to indicate that the administration is pursuing a sound economic policy, and has in view the future quite as much as the present. It has replanted at great expense millions of rubber vines which will only yield a return in the next generation. The State has resisted the temptation to raise an enormous revenue from the liquor excise duty on the sale of alcoholic liquor, and it has prohibited the trade in the whole of the Upper Congo. The State has done everything in its power to encourage missionary enterprise. It is a remarkable fact that of all tropical countries the Congo is the one where missionary work has expanded most rapidly. After less than twenty years, the Catholic and Protestant missions have now more than 600 missionaries of both sexes, devoting themselves to the work of evangelisation. Which is the tropical African colony that can show 600 clergymen and priests and sisters of mercy?

Congo Natives.

The State realises that the missionary who raises the material and moral standard of life of the natives is the surest ally and fellow-

worker of the trader and the administrator. For, indeed, so long as the native remains the untutored child of nature, inaccessible to the influences of Christianity, he will continue to live in his wretched huts, he will be a nomad in the forest, he will be content with satisfying the simplest animal wants, and for the satisfaction of these wants he will make his women work. And having no material wants nor moral needs, he will lack the first stimulus, and fail to acquire the habit of work. And the State will fail to receive the supply of native labour which alone will make it possible to develop the resources of the country.

Group of Hollos.

The two problems which, therefore, missionaries and rulers have to face and to solve are:

1. To create the habit of work and to preach the dignity of labour. To attain that desirable consummation, the present system of enforcing a labour tax instead of a tax in kind has been adopted.

2. To raise the standard of living in order to create new wants and desires. Here again the Government, by building model stations for its officers, model villages for its soldiers, model schools and churches for the missionaries, and by laying out beautiful plantations and gardens —is moving in the right direction. When the natives have constantly before them these concrete examples of a higher civilisation with its infinite complexity, new desires will arise in them for the satisfaction of which they will be compelled to give their labour, which in turn will be applied to the development and expansion of their vast country.

At Upoto.

IV.

We have so far indicated the economic conditions of Belgian Africa, and the economic principles which guide the Congo administration, and which explain its economic expansion. We shall now briefly sum up the political statistics of the young colony—as the political development is so intimately bound up with the economic progress. Most of our facts are taken from the last report of the Vice-Governor General to the Secretary of State (1904).

There are at the present time 233 posts and stations, all of them under the command of white men scattered over the fourteen territorial and administrative districts.

The European staff attached to the services of the districts mentioned is distributed as follows:—

Organic Staff,	294
Service of Justice,	57
Administrative Service,	115
Medical Service,	27
Service of Public Works,	92
Service of Agriculture,	89
Service of Finance,	74
The Public Force,	490
Service of the Marine,	166
Various,	20
Total,	1424

The number of blacks allocated to the different civil and military services is about 20,000 men.

If we classify the 1424 white officials of the State, we notice that the Free Congo State has largely retained the international character which it had from its foundation, and that almost every civilised nation is represented on the staff of the administration.

Belgians,	898	Brought forward,	1394
Italians,	197	Austrians,	3
Swiss,	89	English,	16
Swedes,	86	Americans,	2
Danes,	34	Turks,	2
Germans,	31	Luxemburgers,	2
French,	4	Portuguese,	2
Norwegians,	22	Greeks,	1
Finns,	19	Spaniards,	1
Dutch,	9	Cubans,	1
Russians,	5		
Carry forward,	1394	Total,	1424

In order that the staff may become more experienced, by acquiring progressively a knowledge of the country, its resources and its inhabitants, it has been particularly recommended to the agents composing it

that they should learn the native dialects. Knowledge of the local idioms is, indeed, indispensable for the European to enter into direct relations with the blacks. Unfortunately the Congo official, owing to the deadly nature of the climate, is often compelled to leave the service at the very moment when he has become most useful, and when he has succeeded in assimilating the language and manners of the native population. It is only possible in the healthier parts of the Congo to secure that perfect experience which a long sojourn is alone able to give to a European official.

The professional judges number at the present time thirty-two. They are assisted by twenty-five judicial agents.

The judicial services of Boma, to which are allocated seven professional judges and a dozen judicial agents, are organised into—

1. An Appeal Court, composed of a president and two judges, of the State prosecutor, and of a registrar.

2. A Council of War of Appeal, the presidency of which devolves on the president of the Appeal Court, of two judges, officers of the Public Force, of the State prosecutor, and of a registrar.

3. A Court of First Instance, composed of a professional judge, of a deputy, a doctor of laws, and of a registrar.

4. A Council of War of First Instance, composed of a judge, an officer of the Public Force, of the representative of the Court of First Instance, and of a registrar.

The above professional judges are distributed between the territorial courts which exist at Matadi, Leopoldville, Popokabaka, Coquilhatville, New Antwerp, Basoko, Harleyville, Albertville, Lukafu, Kabinda (Katanga), Lusambo, and at Uvira, in the Kivu Zone.

Among the officials of judicial rank are Belgians, Italians, Danes, Swiss, Norwegians, etc.

A large number of stations devote themselves to the breeding of cattle. There are now seventy breeding establishments distributed throughout the State. There were, in 1904, 4283 cattle.

The following table shows the increase of the coffee and cocoa plantations between 1894 and 1902 :—

Year.	Coffee plants.	Cocoa plants.
1894	61,517	13,867
1895	241,446	36,675
1896	494,069	87,896
1897	1,167,259	104,813
1898	2,021,178	190,160
1899	2,364,634	386,269
1900	2,631,183	490,695
1901	2,533,559	308,451
1902	1,996,200	298,003

With regard to plantations of rubber vines the decree of 5th January 1899 provided that in all forests of the Sudan there shall be planted every year a number of caoutchouc trees or leaves which shall not be

less than 150 feet per ton of caoutchouc collected therein during the same period.

The total number of plants put into the ground by companies and by the State may be valued respectively at about 1,500,000 and at more than 3,000,000 fr.

Experiments on the cultivation of cotton are now extensively being made on the Lower Congo.

The statistics of the lines of communication indicate an equally remarkable advance. The State flotilla of steamers on the Upper River and its affluents numbers thirty. That of companies and private traders numbers forty. With regard to railroads and routes, a new route for a railroad from Stanleyville to the Great Lakes has been surveyed. This survey comprehends a principal track from Stanleyville-Bafwaboli Mawambi-Irumu, 762 kilometres in length. Near Irumu the track branches off in two directions, one Irumu-Mahagi of 358 kilometres, the other Irumu-Beni of 135 kilometres. At present the surveys are being made for a track from Beni to Lake Tanganyika.

Tapping Rubber Vines in the Forest of Lusambo.

In addition the track has been completely surveyed for a railway from Dufile to Redjaf following the left bank of the Nile, which would be 157 kilometres in length. This railway would turn the innavigable part of the river. At this moment a line is being constructed between Stanleyville (left bank) and Ponthierville. This line will be 140 kilometres in length. The rails have been placed over 10 kilometres, and the embankment over 50 kilometres. This line will permit of transports being made on the river above Ponthierville. As soon as this first line is finished, others will be constructed along the innavigable parts of the river. Surveys are also being made for a railway connecting a part on the southern frontier of the Congo Free State (Katanga) with a point situated on the Lualaba south of the junction of that river with the Lufira. The approximate length of this line, the survey of which commenced on the spot as far back as 25th April 1903, will be about 500 kilometres.

The Government has also given attention to the construction of routes for motor cars; two chief routes of this kind are being constructed, the first of which is on the Uelle between Redjaf and Ibembo. It will be about 1250 kilometres in length, of which, according to the latest information furnished, 400 kilometres are now open to use. Experiments are being made here by means of three steam wagons. The second starts from Tongololo, a station on the railway from Matadi to the Pool, and proceeds to Popokabaka on the river Kwango.

Roads destined for transport by wagon are besides in course of execution, and in some parts of the territory are sufficiently advanced to permit of transport by oxen, particularly on the Uelle, Katanga, and Manzema. The Matagi-Irumu route is working for a length of 165 kilometres; eleven large villages are now established along this route, at distances of from 13 to 16 kilometres from each other.

In addition to these lines of communication, the State has established thirteen telephonic and telegraphic stations. The principal centres are :—

Boma-Matadi	52	kilometres.
Matadi-Tumba	185	,,
Tumba-Leopoldville	215	,,
Leopoldville-Kwamouth	233	,,
Kwamouth-Mopolenge-Yumbi	177	,,
Yumbi-Lukolela	121	,,
Lukolela-Irebu	102	,,
Irebu-Coquilhatville	114	,,
Total,	1199	kilometres.

But the most significant proof of the extraordinary recent development of the Congo Free State is probably the statistics of the religious missions.

In 1903, the Catholic missions indicate :—

59 permanent and 29 temporary posts.	75 primary schools.
384 missionaries and sisters.	440 elementary schools.
528 farm-chapels.	7 hospitals.
113 churches and chapels.	71 Christian villages.
523 oratories.	72,382 Christians and catechumens.
3 schools of the second degree.	

The Protestant missionary statistics indicate :—

221 missionaries.	10,162 children attending weekday schools.
40 stations.	5,641 ,, ,, Sunday schools.
6521 communicants.	

The facts and figures just given are an eloquent commentary and illustration of the principle expounded in the first part of the paper, and looking at the situation in the light of these figures, there seems to be little doubt that the Congo Free State will carry out more and more systematically the economic policy which they initiated twenty years ago.

Of course in colonisation, and especially in the colonisation of Africa, it is the unexpected that often happens. It may be well to remember that in Rhodesia in 1896, when everything pointed to a long spell of

prosperity, suddenly an outburst of every calamity: drought and failure of the crops, plague, famine and rebellion, brought the young colony to the verge of destruction. In the same way, at present in the Congo the sudden outburst of a deadly disease, the sleeping sickness, is threatening to decimate the native population. But if, as is likely, the young colony emerges triumphantly from the crisis as it has overcome more trying ordeals in the past, every sign points to the coming of a long era of prosperity and expansion, under the blue flag bespangled with the golden star, a fitting symbol of hope and redemption for what was once the darkest spot and the most disinherited race of this planet.

THE PROPOSED CHAIR OF GEOGRAPHY IN THE UNIVERSITY OF EDINBURGH.

By General CHAPMAN, C.B.

A COMMITTEE has been formed for the promotion of a Chair of Geography in the University of Edinburgh, and have issued an appeal for support, from which we quote the following paragraphs:—

"The claims of the science of Geography as a University subject have long been recognised by the leading German, French, and American Universities, and in recent years the Universities of Oxford and Cambridge have established schools of Geography, but as yet there is no special teaching of Geography in any Scottish University. The efficient teaching of Geography in our schools and colleges is one of the most urgent needs of our time, affecting the political and commercial welfare of the Empire, and it is believed that the subject cannot be satisfactorily dealt with until our Universities take it up and provide, in the first place, adequate training for teachers.

"Towards this end an important step has been taken by the Senatus of the University of Edinburgh in approving of Geography as a subject qualifying for graduation in the Faculties of Science and Arts, and in response to various representations, the University authorities have given their approval to the proposal for the establishment of a Chair of Geography in the University of Edinburgh.

"The Councils of the Royal Scottish Geographical Society and the Royal Society, and the Edinburgh Merchant Company, have also expressed themselves as favourable to the object in view, and a Committee representative of these and other bodies has been formed to raise the necessary funds for the endowment of the Chair."

We have little doubt that our readers will be interested in the proposal to establish a Chair of Geography in the University of Edinburgh; and that the action of the Senatus in recognising the claims of Geography to rank as a University subject will be welcomed, not only throughout Scotland, but wherever there are Scotsmen—administrators, soldiers, sailors, missionaries, merchants, or teachers, who in their work

as empire-builders look back with gratitude to the University to which they owe so much.

Year by year the struggle for the possession of such parts of the earth as are not already appropriated by one or other of the great nations becomes keener and keener, and in this struggle the importance of Geography becomes ever more evident. The dispute over the Alaskan boundary turned almost entirely on the geography of the country, and would probably have never arisen had those who originally drew up the treaty between Russia and Canada been thoroughly acquainted with the facts; the recent determination of the boundary between Chile and Argentina, and the acceptation of the King's award in November 1902, is a remarkable instance of the triumph of geographical knowledge. The same thing is happening every day in one part of the world or another, so that it seems hardly necessary to emphasise the importance of sound geographical knowledge to our statesmen and diplomatists.

To soldiers and sailors it is hardly less important, taking into consideration the influence on their operations of the geographical features of a country, its climatic conditions, its resources, the character of its inhabitants, etc.; but indeed it is to officers of the army and of the navy that we are mainly indebted for the vast additions to our geographical knowledge made during recent years.

The mere utilitarian importance of Geography to the practical man of business can with difficulty be overestimated; whether he be engineer, or contractor, or investor, geographical conditions must determine the direction of his efforts and control their result; even the merchant, seeking new outlets for his commercial activity, new markets for his wares, or new sources of supply for his raw products, must be largely dependent on a knowledge of Geography, either in himself or in others.

Of the value of Geography in its relation to history it is hardly necessary to dwell, since that has long been recognised, at least in theory: but the study has been given a subordinate place, and a knowledge of it has not been found to "pay" in examinations, whether at the universities or in those conducted by the Civil Service Commissioners. For these reasons it has been neglected in our public schools and in most of our private schools to a degree that can only be described as scandalous. Now, however, that public interest has been aroused, and that the universities are recognising the study as one of real value, the schoolmasters may be trusted to follow their lead, and to pay some attention to Geography; and there can be no question but that if intelligently taught it can be made a subject of fascinating interest to boys and girls. Of this we have never ourselves doubted, since hearing a geography lesson given in an Edinburgh Board School.

In order that a Chair of Geography may be founded in Edinburgh, there must be an enthusiastic response to the Committee's appeal for funds to endow the Chair, but it is felt that the claims of the subject are so strong, that the project only requires to be made known to command public support. We trust that our readers will do their best to support it and make it more widely known.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.[1]

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART VII.—LOCHS OF THE SHIEL DISTRICT.

Loch Shiel.—Loch Shiel is one of the larger Scottish freshwater lochs, having a total length of 17½ miles. In this respect it is inferior only to Lochs Awe, Ness, and Lomond, which are 23, 22¾, and 22 miles in length respectively, and is closely followed by Loch Shin, which is 17¼ miles in length. Its elevation above the sea is only 11½ feet, so that a slight subsidence of the strip of land through which the river Shiel flows would convert it into an arm of the sea. Seals occasionally make their way into the loch from the sea at the present time. The principal upper portion of the loch trends in a north-east and south-west direction, but about six miles above the outflow there is a bend in the outline of the loch, and the lower portion trends almost due west. The river Shiel follows a north-westerly course for about two miles before emptying itself into Loch Moidart. The scenery around the loch is very fine, becoming grand and wild towards the head. At the foot of the loch the surrounding ground is low, but on proceeding up the loch mountainous country occurs on both sides, culminating in heights exceeding 3000 feet at the head of Glen Finnan. To the south rises Ben Resipol (2774 feet), between Loch Shiel and Loch Sunart; to the east Sgor an Tarinachain (2474 feet), Meall Mor (2487 feet), Meall nan Creag Leac (2474 feet), Glas Garbh (2369 feet), Meall Doire na Mnatha (2094 feet); to the north Beinn nan Tom (2603 feet), Streap (2988 feet), Sgor Choileam (3164 feet), Sgor nan Choireachan (3133 feet), Fraoch-bheinn (2489 feet); to the west Beinn-Odhar (2895 feet), Druim Fiaclach (2851 feet), a' Chroit-bheinn (2178 feet), and Beinn-Gaire (2179 feet). The principal feeders are the river Finnan, Amhainn Shlatach, and Callop river, which enter the loch at its head, Glenaladale river entering about six miles down on the north-western shore, and the river Polloch (bearing the outflow from Loch Dilate), entering about eleven miles down on the south-eastern shore, where the bend in the trend of the loch occurs. There are numerous small islands and a few larger ones, the largest being Eilean Gleann Fhionainn at the head of the loch, while on Eilean Fhianainn, at the narrows towards the foot of the loch, are the remains of St. Finnan's Church and a romantic burying-place of the Clanranald. At the head of the loch stands Prince Charlie's monument, erected by the late Colonel Macdonald of Glenaladale, on the spot where that ill-fated Prince raised his standard. Salmon, grilse, sea trout and brown trout abound in the loch, and yield fair sport, some of the salmon and trout being very heavy.

[1] Abstract of a paper which appears in full, with maps and figures, in the *Geographical Journal*, xxv. 3.

Considering its great length, Loch Shiel is very narrow, for at no place does it attain the width of a mile, the maximum breadth being about nine-tenths of a mile, and this occurs at the great bend in the outline of the loch, opposite the entrance of the river Polloch. The mean breadth of the loch is less than half a mile, being only $2\frac{1}{2}$ per cent. of the length—a smaller percentage than has been observed in any of the larger lochs surveyed by the Lake Survey, the lochs most nearly approaching it in this respect being Loch Shin with 3 per cent., and Loch Ness with 4·3 per cent. The waters of Loch Shiel cover an area of over $7\frac{1}{2}$ square miles, and it drains directly an area of over $72\frac{1}{2}$ square miles, but, since it receives the outflow from Loch Dilate, its total drainage area is about $85\frac{1}{2}$ square miles—an area over eleven times greater than that of the loch. Over 700 soundings were taken, the maximum depth recorded being 420 feet about four miles from the head of the loch, between the heights of Beinn a' Chaoruinn and Beinn Odhar Bheag to the north-west, and of Meall nan Creag Leac to the south-east. The volume of water contained in the loch is estimated at 17,215 million cubic feet, and the mean depth at $81\frac{1}{2}$ feet, or nearly 20 per cent. of the maximum depth. Loch Shiel was surveyed on July 2 to 9, 1902. The elevation of the lake surface above the sea was determined by levelling from bench-mark as being 11·4 feet; when levelled by the officers of the Ordnance Survey on November 6, 1897, the elevation was found to be 12 feet above sea-level. The water may rise to 4 or 5 feet higher than the level given above.

The floor of Loch Shiel is on the whole rather irregular. The 50-feet contour-line encloses a continuous area extending from close to the upper end to within two miles from the lower end at Acharacle, but all the deeper contours are broken up so as to enclose two or more isolated areas. The 50-feet contour follows approximately the general outline of the loch, but it is in places of a sinuous character. At the head of the loch it extends both to the north-west and south-east of Eilean Ghleann Fhionainn. About two miles down there are sinuosities in the contour on both sides of the loch, due to a tongue of deep water projecting between the south-eastern shore and the island Sgeir Ghiubsachain, and to a shoaling of the water off the north-western shore from 33 to 15 feet. Further down, off the north-western shore, above the entrance of the Glenaladale river, there is a twist in the 50-feet contour, where the water shoals from 55 to 20 feet. Still further down, opposite the entrance of the Allt na Dalach, sinuosities in the 50-feet contour occur on both sides of the loch, the water shoaling off the south-eastern shore from 41 to 19 and 22 feet. The last-mentioned shoaling occurs to the north-east of Eileanan Comhlach, at the entrance of the Alt a' Ghiubhais, and it is curious to observe a similar shoaling on the opposite (south-west) side of the island from 41 to 18 and 21 feet, while between the island and the mouth of the stream a depth of 32 feet was observed.

Towards the lower end of the wide part of the loch, and almost due south of Eilean Druim nan Laogh (or Heron Island, as it is now called in the district), there is, near the middle of the loch, a shoal covered by

only 2 or 3 feet of water. During the visit of the Lake Survey the regular mail steamer was laid up for repairs, having shortly before struck on this shoal and damaged the propeller. The captain of the steamer supplied information as to the position of the shoal, and the local gillie employed by the surveyors stated that in calm weather the bottom can be seen, but in the stormy weather prevailing at the time of the survey he was unable to find it, so that it must be of very small extent, for deep soundings were recorded near the spot indicated. The same gillie stated that a shoal bank extended from Ruadh Bac na Moine in an approximately south-west direction towards the opposite shore; this was confirmed by fishermen, and was probably indicated by the outward bend of the 50-feet contour-line at that place.

The 100-feet contour-line is less sinuous in character than the 50-feet contour, the main basin being about twelve miles in length, extending from near the head of the loch to the narrows at Eilean Fhianain, with two small subsidiary basins; one off Rudha Leathan about 3½ miles from the foot of the loch, based on a sounding of 112 feet; the other between the promontory on the south-eastern shore called Rudha Torr a' Chonnaidh and the outlying islands, about seven miles from the head of the loch, based on a sounding of 148 feet. A remarkable rise of the bottom was observed within the main 100-feet basin, about a mile above the entrance of the river Polloch, where soundings of 84 and 43 feet were taken, surrounded on all sides by about 150 feet of water. The main 200-feet basin is nearly eight miles in length, approaching to within half a mile from the head of the loch, and extending as far down as Eileanan Comhlach. There are two small subsidiary basins, separated from the main basin by an interval of over half a mile, between the entrance of the Alt na Claise on the south-eastern shore and the entrance of the An Garbh-alt on the north-western shore. This line of soundings shows a curious configuration of the bottom, which rises in the central part of the loch and sinks again on both sides nearer the shore: thus, on proceeding from south-east to north-west the water deepens to 201 feet, then shoals again to 122 feet, then deepens again to 172, 209, and 224 feet, shoaling again to the north-western shore. It is interesting to note the close proximity of these two small deep basins to the rise covered by 43 feet of water already mentioned. The 200-feet contour shows a peculiar loop off the north-western shore, about four miles from the head of the loch, where the water shoals from 199 to 163 feet. The principal 300-feet basin is distant about a mile from the head of the loch, and extends down the loch for over four miles, enclosing the deepest parts of the loch. Separated from this basin by an interval of a quarter of a mile (in which the greatest depth is 282 feet) is a second small basin based upon a sounding of 307 feet, and after a similar interval (in which the greatest depth is 284 feet), there is a third 300-feet basin two miles in length, having a maximum depth of 385 feet. Within this third basin there is a slight rise of the bottom, covered by 288 feet of water. There are two small basins with depths exceeding 400 feet, the smaller about three miles from the head of the loch, based on soundings of 416 and 419 feet,

separated by an interval of three-quarters of a mile (in which the greatest depth is 375 feet) from the larger, which is less than a mile in length and encloses the maximum depth of the loch (420 feet), recorded near the north-eastern end of this larger basin, and over four miles from the head of the loch.

From the foregoing description it will be noticed that in Loch Shiel the deeper water occurs towards the head of the loch. Proceeding from Acharacle at the foot of the loch, one must row two miles up before encountering a depth of 50 feet, a further 1½ miles before meeting with a depth of 100 feet, and this merely a small patch, a further 1½ miles having to be traversed before reaching the main 100-feet basin, or a total distance of five miles from the foot of the loch. The main 200-feet basin is distant about nine miles, the lower 300-feet basin nearly ten miles, and the principal 400-feet basin over twelve miles, from the foot of the loch.

Loch Dilate.—Loch Dilate (or Doilate) lies about one and a half miles to the east of the lower portion of Loch Shiel, into which it flows by the river Polloch entering Loch Shiel about six miles above its outflow. The ground between the two lochs is low, the fall from Loch Dilate to Loch Shiel being only 10½ feet, but high and mountainous country surrounds Loch Dilate in all other directions. The principal feeder is the river Hurich, which takes its rise in Lochan Dubh at the head of Glen Hurich, and after a course of six miles empties itself into the east end of Loch Dilate. The loch trends east and west, and is nearly one and a half miles in length. It is widest towards the east end, where the maximum breadth is over one-third of a mile, the mean breadth being about one-seventh of a mile. Its waters cover an area of about 142 acres, or nearly a quarter of a square mile, and it drains an area fifty-eight times greater, or nearly 13 square miles. Forty-five soundings were taken in Loch Dilate, the maximum depth observed being 55 feet. The volume of water contained in the loch is estimated at 145 million cubic feet, and the mean depth at 23½ feet, or 43 per cent. of the maximum depth. The loch was surveyed on July 8, 1902, and the elevation of the lake surface above the sea by levelling from bench-mark was found to be 22 feet. When levelled by the officers of Ordnance Survey on October 16, 1867, the elevation was found to be 23·4 feet above sea-level.

Loch Dilate forms a simple basin, the deeper water being centrally placed, and the contour-lines following approximately the outline of the loch. A sounding of 12 feet was recorded off the bay in the south-east corner of the loch, apparently surrounded by shallower water, though possibly continuous with the 10-feet area, but this is the only irregularity in the lake floor indicated by the soundings. Along the central portion of the southern shore the contour lines closely hug the shore, indicating a comparatively steep slope in this locality.

Loch Eilt.—Loch Eilt lies about 1½ miles to the east of the head of Loch Ailort (into which its outflow is carried by the river Ailort), and about four miles to the west of Glenfinnan. The hills around it rise steeply to a height of 1500 feet, the highest points exceeding 2000 feet.

It was formerly considered a good loch for salmon and sea-trout; but Mr. Harvie-Brown believes that the blasting operations during the construction of the Mallaig extension of the West Highland railway resulted in the destruction of a large amount of spawn and fry, and that now the fish are greatly disturbed by the passage of the trains across the bays on the south shore.

Loch Eilt trends east and west, and is 3½ miles in length, with a minimum breadth of half a mile, the mean breadth being one-fifth of a mile. Its waters cover an area of about 424 acres, or two-thirds of a square mile, and it drains an area of 12 square miles. Over 250 soundings were taken, the maximum depth recorded being 119 feet. The volume of water contained in the loch is estimated at 686 million cubic feet, and the mean depth at 37 feet. The loch was surveyed on July 9 and 10, 1902; the elevation of the lake-surface was found, by levelling from bench-marks, to be 96·4 feet above the sea. The keeper stated that the water might rise about 3 feet above, and fall about 9 inches below, this level. During the night of July 9 and 10, 1902, the water rose nearly 10 inches.

Loch Eilt is naturally divided into three portions by two narrow constrictions in its outline, the western portion being by far the largest and deepest, covering an area of about 360 acres, while the area of the central and eastern portions is in each case about 32 acres. The western portion is connected with the central portion by a channel 6 feet in depth, with a rocky islet in the centre, the sides of the channel being also of rock *in situ*, thus dividing the rock into two rock-basins; the central portion is separated from the eastern portion by detritus brought down by the Alt a' Choire Bhuidhe, the channel between them having a depth of 7 feet. The small eastern and central basins are quite simple in conformation, the maximum depth observed in the eastern one being 52 feet, and in the central one 70 feet. The floor of the large western basin is much more irregular, for there are four areas with depths exceeding 50 feet: (1) a small area near the east end, based on a sounding of 52 feet; (2) the main 50-feet area, which encloses the deepest part of the loch, over a mile in length, and with a rocky islet rising to the surface near its western margin; (3) a small area between the large island (Eilean More) and the northern shore, based on a sounding of 55 feet. At the extreme west end of the loch, between the two islands, a depth of 40 feet was recorded. The 75-feet area is about half a mile, and the 100-feet area about a quarter of a mile, in length, occupying the wide central part of the western basin, but rather nearer the east than the west end. The deepest part of the loch falls below sea-level (the 100-feet contour-line corresponding approximately with the level of the sea), and is flat-bottomed in character.

Loch Dubh.—Loch Dubh is a small loch situated at the head of the peninsula of Ardnish, which separates Loch Ailort from Loch nan Uamh, the two branches of the Sound of Arisaig. The Mallaig extension of the West Highland railway runs along its southern shore, and the outfall flows through the old bed of the little Lochan Deabhta, which has been completely drained by the railway, leaving only a

channel through it for the escape of the waters from Loch Dubh. After leaving Lochan Deabhta the outfall joins the Schoolhouse burn, which has been deflected, thence falls into the Arabol burn, falling into the head of Loch Beag, an inlet of Loch nan Uamh. It is surrounded, except on the western side, by low, though steep hills, which impart a dark and sullen appearance to the loch, hence its name—the Black Loch. Considering its superficial area, it is the deepest loch visited by the Lake Survey. Its great depth, and the remarkable temperature conditions discovered in it, well repaid the trouble of carting a boat from Loch nan Uamh and carrying it down to the loch. Its catchment area is very small, and it would seem that the unpleasant taste of its water, resembling that of a stagnant pool, is due to the small amount of fresh water entering it. This unpleasantness is probably something more than mere taste, for attempts to stock the loch with trout have been unsuccessful, the fish dying rapidly; eels, however, abound in it.

Loch Dubh trends in a north-west and south-east direction, the broadest part being rather near the south-east end. Its length is under half a mile, its maximum breadth one-sixth of a mile, and its mean breadth one-tenth of a mile. Its waters cover an area of about 32 acres, and it drains an area eight times greater, or about 262 acres. Sixty-five soundings were taken, and the maximum depth observed was 153 feet, which bears the ratio to the length of the loch of 1 to 15. This low ratio is only equalled by the little loch on Eilean Subhainn in Loch Maree, and the loch which most nearly approaches it is Loch Fender in the Tay basin, in which the ratio is as 1 to 22, followed by Loch Dhugaill, near Kishorn, in which the ratio is as 1 to 27. Among the larger Scottish lochs, the nearest approach is found in Loch Treig, with a ratio of depth to length of 1 to 62. The volume of water contained in the loch is estimated at 86,956,000 cubic feet, and the mean depth at nearly 63 feet, or 41 per cent. of the maximum depth. The loch was surveyed on July 10, 1902; the elevation of the lake surface above the sea was found, by levelling from bench-marks, to be 103 feet; when visited by the Ordnance Survey officers on August 6, 1869, the elevation was 103·3 feet above sea-level. No drift-marks were seen, but the keeper stated that the annual range in level was about 9 inches.

Loch Dubh is very simple in conformation, the contour-lines following approximately the shore-line. Near the north-west end there is a slight rise of the bottom, but otherwise the lake floor slopes down regularly to the deepest part, which lies towards the north-eastern shore. The maximum depth of 153 feet was observed at a distance of about 120 feet from this shore, giving a slope of 59°; the height of the hill immediately adjoining is 240 feet, and the slope 35°; hence the slope from the top of the hill to the bottom of the loch is one of 45°.

The temperature conditions of the loch are remarkable, for in July 1902 it was found that, while the surface water was 59·0° F., the bottom water had the low temperature of 43·5° F.

Lochs Màma and na Creige Duibhe doubtless formed at no distant date one sheet of water, which was gradually separated into two portions

by the deposition of material brought down by the Allt Dearg. This is evidenced by the fact that locally the name Màma is applied to both divisions, but in this place that name is restricted to the western basin, the name na Creige Duibhe being applied to the larger and deeper eastern basin. The connecting stream is about sixty yards in length, with a depth of 7 to 8 feet, the fall from Loch na Creige Duibhe to Loch Màma being less than a foot. The tract of alluvium separating the two lochs was about 2½ feet above the water of Loch Màma, and the keeper stated that he had often seen it flooded when the lochs were high. The hills along the northern and southern shores of the lochs rise steeply up to heights exceeding 1000 feet, approaching 2000 feet along the northern shores, down the sides of which a few torrents rush after heavy rains. The two lochs trend east and west, and the outflow from Loch na Creige Duibhe passes into Loch Màma, and thence by the Gleann Màma into Loch nan Uamh.

Loch Màma.—Loch Màma is over one-third of a mile in length, one-eighth of a mile in maximum breadth, and one-twelfth of a mile in mean breadth. Its waters cover an area of about 17 acres, and it drains directly an area of two-thirds of a square mile: but since it receives the outflow from Loch na Creige Duibhe its drainage area is over two square miles, an area seventy times greater than that of the loch. Nearly forty soundings were taken, the maximum depth observed being 44 feet. The volume of water contained in the loch is estimated at 11 million cubic feet, and the mean depth at 14·4 feet. The loch was surveyed on July 11, 1902, and the elevation of the lake surface above the sea was determined from spot-levels as being 359 feet. It forms a simple basin, the deepest part being found towards the east end.

Loch na Creige Duibhe.—Loch na Creige Duibhe is four-fifths of a mile in length, one-eighth of a mile in maximum breadth, and one-fourteenth of a mile in mean breadth. Its waters cover an area of about 36½ acres, and it drains an area twenty-four times greater, or about 1½ square miles. Over seventy soundings were taken, the maximum depth recorded being 93 feet. The volume of water is estimated at 52 million cubic feet, and the mean depth at 32½ feet. The loch was surveyed on the same day as Loch Màma (July 11, 1902); the elevation of the lake surface above the sea, from spot-level and by comparison with Loch Màma, was found to be 359·7 feet. An inspection of the map shows Loch na Creige Duibhe to be (like Loch Màma) a long narrow basin of very simple conformation. It is much deeper than Loch Màma, and the deeper water approaches nearer to the west than to the east end, that is to say, nearer to the alluvial cone separating the two lochs. A similar state of matters has been noted in the case of Lochs Voil and Doine in the Forth basin, formerly a continuous loch, now divided into two portions by the deposition of material brought down by the river, where deep water approaches close to the dividing promontory of land on both sides.

Geology of the Loch Shiel Catchment Basin.—Though the basin of Loch Shiel has not been surveyed by the Geological Survey, we understand that certain members of the staff have examined the rock cuttings

on the line of railway between Loch Eil and Kinlochailort. The rocks exposed in these cuttings consist of muscovite-biotite gneiss and flaggy mica-schists, which are included in the Moine series of crystalline schists by the Geological Survey. The general strike of these strata is north-east and south-west, so that in all likelihood they are continued to the south-west along both sides of Loch Shiel. This conclusion is supported by the fact that on the lofty watershed between Loch Shiel and Loch Linnhe these muscovite-biotite gneisses have been mapped by the Geological Survey. These schists and gneisses, which are supposed to represent altered sediments, are traversed by numerous veins of pegmatite, dolerite, and dykes of diorite, and basalt.

On the watershed between Glen Hurich and Glen Scaddle, on the crest of Sgor Dhomhail (2915 feet), there is a mass of foliated granite, and, further to the south-east, the later igneous intrusions of the Strontian district may enter the Loch Shiel Catchment Basin.

Notes on the Biology of the Lochs in the Shiel District.—Of the six lochs dealt with in this paper, tow-nettings were taken in four, and a shore netting in a fifth. The biology presented little of special interest; *Diaptomus laciniatus* was found in two of the lochs (Shiel and Eilt); these are the most southerly lochs in which this northern species was found by the Lake Survey, though it has been recorded by Dr. Scott from one loch (Loch Doon) much further south.

Loch Shiel.—Owing to the great abundance of Holopedium, which choked up the nets, it was difficult to collect other animals in any numbers. The most plentiful animals were : *Diaptomus gracilis, Diaptomus laciniatus, Cyclops strenuus, Bosmina obtusirostris,* Bythotrephes, Polyphemus, six species of pelagic Rotifers (including *Floscularia pelagica*) and Dinobryon. The plants noted were : *Xanthidium antilopeum, Staurastrum gracile,* and *Staurastrum braziliense.* Lobelia and Littorella were in flower at the upper end of the loch.

Loch Dilate.—As compared with Loch Shiel, the most notable features of this loch were the greater abundance of life, the absence of Holopedium and *Diaptomus laciniatus,* and the presence of *Diaphanosoma brachyurum* in considerable numbers. Among the organisms observed were : *Diaptomus gracilis, Cyclops strenuus, Synchæta pectinata, Plæsoma truncata,* Dinobryon, Peridinium, two species of Ceratium (*C. hirundinella* and *C. cornutum*), *Anabæna flos aquæ* with its adherent Vorticellæ.

Loch Eilt.—Life was abundant, the characteristic animals being Holopedium, *Diaptomus laciniatus, Cyclops strenuus, Anurœa cochlearis, Notholca longispina,* and Polyartha. Leptodora and Bythotrephes were scarce, but *Bosmina obtusirostris* and a variety approaching *B. longispina* were seen. The brilliant red and blue Rotifer, *Notops pygmœus,* was plentiful. Some immature specimens of *Diaptomus* probably belonged to *D. gracilis.* On the mud in the deepest of the loch were numbers of pretty little green larva of an insect, enclosed in transparent flask-shaped cases.

Loch Dubh.—This little loch, remarkable for its great depth and the temperature conditions, was examined on two occasions. On the first visit in July 1902 the surface temperature was 59° F., while on the second visit in March 1903 the temperature throughout was about

41° F. Notwithstanding this difference in temperature, there was little difference in the animals observed on the two occasions. Those found in July were :—*Diaptomus gracilis* (blue and red, grey, red, blue), *Cyclops strenuus*, *Bosmina obtusirostris* (small purple), *Daphnia lacustris* (all pale red), Eurycercus, Polyphemus, Triarthra, Polyartha, *Anuræa cochlearis*, Conochilus, *Ceratium hirudinella*, Dinobryon. In March all the same animals were found, except Polyphemus, and there were in addition a few larvæ of Corethra (phantom larvæ), *Notholca foliacea*, a second species of Ceratium (*C. cornutum*—less common in lakes), Mallomonas, and a very small form of Astrionella. Near the shore large spheres of Ophridium were found on the weeds. In the mud from the bottom were found many Rhizopods of the species *Cyphoderia ampulla*, *Difflugia pyriformis*, *D. globulosa*, and *D. arcula*. Lobelia and Myriophyllum were growing along the shore.

Loch na Creige Duibhe.—As this loch was only examined by means of a net thrown out from the shore, it is probable that some of the pelagic animals may have been missed. Those seen were *Diaptomus gracilis*, (reddish), *Cyclops strenuus* (yellow), *Alonopsis elongata*, *Chydorus sphæricus*, *Anuræa cochlearis*, *Bosmina obtusirostris*, *Arcella vulgaris*. A few of the commonest filamentous algæ and desmids were seen. Astrionella was scarce.

ARGENTINE ANTARCTIC STATION.

By R. N. Rudmose Brown, B.Sc.

From the accounts of Mr. R. C. Mossman, the Director of the Meteorological and Magnetical Observatory at Scotia Bay, South Orkneys, it is now possible to give some outline of its first year's work under Argentine auspices. This station, it will be remembered, was built and set in working order during the winter of 1903, which the Scottish National Antarctic Expedition spent at the South Orkneys. When the *Scotia* returned in December of that year to Buenos Aires to coal and refit, Mr. Mossman, the meteorologist, was left in charge of a party to continue the observations until the return of the ship. The Argentine Government agreed with Mr. Bruce to take over the observatory for another year, and in February 1904 the *Scotia* landed three Argentine scientists to remain with Mr. Mossman, who had been asked by the Argentine Government to assume the directorship. Mr. Mossman had with him Messrs. L. H. Valette, H. Acuna, E. Szmula, and William Smith. Mr. Valette was naturalist of the station, and among many valuable observations and collections made by him perhaps the most interesting are the capture of a young Ross Seal (*Ommatophoca Rossii*) and the record of a Sea Elephant (*Macrorhinus leoninus*), which came ashore at Scotia Bay on April 11th, but was not captured. This is the first recorded occurrence of a Sea Elephant at the South Orkneys.

Mr. William Smith was originally a member of the *Scotia*'s crew, and agreed to remain a second year with Mr. Mossman.

The weather experienced at the South Orkneys in 1904 seems to have been very different to that in 1903, being more severe, but fine for longer periods at a time.

The lowest temperature of the year occurred on August 3rd and 4th. On both these days a minimum of -40° F. was recorded, with a mean on the latter day of -33° F. In 1903 the minimum registered was -26° F. on June 19th, and the mean of that day was $-19{\cdot}3^{\circ}$ F. On June 26th, 1904, the daily mean was -19° F., with a minimum of -26° F. In 1903 the coldest snap of the year was from September 1st to 4th, with a daily mean of $-21{\cdot}8^{\circ}$ F. on the 2nd, and a minimum of $-25{\cdot}8^{\circ}$ F. In both 1903 and 1904 a cold snap occurred in October with a minimum of $-9{\cdot}1^{\circ}$ F. on October 3rd, 1903, and a minimum of $-25{\cdot}0^{\circ}$ F. on October 11th, 1904. October 1904 had a monthly mean of $18{\cdot}4^{\circ}$ F. as compared with $27{\cdot}0^{\circ}$ F. in 1903.

The other monthly means of 1904 are not yet obtainable, but those figures will show how much the temperature of the two years has differed. Mr. Mossman notes that December of last year was a cold month with almost continuous frost; in 1903 the mean of December was $31{\cdot}5^{\circ}$ F., and the lowest temperature recorded was only $25{\cdot}4^{\circ}$ F. In 1903 a phenomenally high temperature of $46{\cdot}8^{\circ}$ F. was recorded on May 31st during a Föhn wind. A similar occurrence took place on August 28th, 1904, but the temperature rose no higher than $40{\cdot}0^{\circ}$ F. Mr. Mossman records the unusual occurrence of a heavy thunderstorm in August and again in October.

The continual snowstorms which were the most unpleasant feature of the weather of 1903 were not nearly so common last year. As late in the winter as the middle of July 1904 there was less than a foot of snow on the beach, while the previous year there were some three or four, and the fact of there being as much as thirty feet less drift in one place under the cliffs shows how much finer the weather must have been.

After July there was more snowfall, but even then it was apparently not so excessive as in 1903.

In 1903 the severest gales were from the NW. to SW., but in 1904 Mr. Mossman mentions at least three severe gales from the SE., a direction from which they were seldom experienced the previous year.

These strong contrasts between the weather of the South Orkneys in two consecutive years are doubtlessly due to the difference in the disposition of the pack ice. In 1903 the pack ice never extended many miles north of the island. Throughout the winter there was probably open ocean within ten miles in that direction and often nearer. On her first approach to the South Orkneys, in February 1903, the *Scotia* met the pack in 60° 20′ S., 43° 50′ W., only some eighty miles north of the latitude of the islands.

In marked contrast was the state of affairs in 1904, when the *Uruguay* had to penetrate 240 miles of pack lying to the NW. of the South Orkneys, her first encounter with the ice being in 58° 40′ S., 50° 30′ W.

In 1903 Scotia Bay was finally frozen on April 1st and broke up again on November 23rd, while in 1904 it was frozen on May 11th;

but when the *Uruguay* left the South Orkneys on January 1st this year it was still frozen, with open water fully two miles off, and heavy pack jammed against its mouth. And so with other bays—two different ones near Scotia Bay were fully two months later in breaking up last year than the year before. Mr. Mossman considers that 1903 must be looked on as an early season for that region. The lower temperatures and more steady weather, with far less snow, made travelling over the floes relatively easy, and certainly much less precarious than it was on the unstable and ever-shifting floes of 1903.

The ice during the past year was everywhere close and compact and in excellent condition for travelling. Comparing the possibilities of sledging and surveying in the two years, Mr. Mossman says, "This season all would have been different; the weather was remarkably fine for days together, and the survey of Coronation Island, an impossibility last winter owing to the disturbed ice conditions, would not only have been practicable but easy."

As regards the natural history of the South Orkneys there appear to have been no great discoveries made this last year, with the exception of the capture of the young Ross Seal and the record of a Sea Elephant noted above. But while penguins were very scarce in 1903 after the month of April, Mr. Mossman has records of flocks of several hundred seen in both May and July, all moving north. However, despite the very different conditions of these two years, the penguins and other birds began to lay at practically the same time in both years. From the number of cuttle-fish beaks found in seals' stomachs the Scottish Expedition had the strongest evidence of the existence of a large cuttle-fish in South Orkney waters, so that the capture by the Argentines of one with a body over six feet long is of special interest.

On December 31st the Argentine sloop-of-war *Uruguay* arrived to embark Mr. Mossman and his companions, and land a party of five for the present year. She sailed again on the following day, and on leaving the South Orkneys struck westward with the intention of searching for records left by Dr. Charcot's Antarctic Expedition in *Le Français*; and Mr. Mossman gives some details of this voyage in addition to what has already been made known.

The South Orkneys were left on January 1st, 1905, and after much difficulty and not without some risk the *Uruguay* sighted the South Shetlands on January 7th, and next morning anchored in the crater harbour of Deception Island. No despatch from Dr. Charcot was found here, and a letter recording the visit of the *Uruguay* was left. Bad weather detained the ship for twenty-four hours, and then she left for Belgica Strait. Wiencke Island, at the south end of the strait, the next spot to be searched, was reached on January 10th. A careful search of the east side of the island failed to reveal any cairn or beacon, and no landing was made. It was unfortunate that Neumayer Channel on the west was blocked with a line of icebergs from Cape Felicie to Cape Astrup, which effectually barred the progress of the *Uruguay* and rendered a search of that side impossible. From this point Commander Galindez had intended to strike SW. into the Pacific, but heavy ice

from Cape Errara to Cape Benard prevented this. The night of January 10th was spent under the lee of Two Hummocks Island, and on the 11th the *Uruguay* sailed for Smith Island. Thick weather was experienced, but, despite an anxious time, the ship was not long in passing Smith Island and gaining the open ocean. Sighting Cape Horn on January 15th, she anchored the same evening at Harberton in Beagle Channel, and two days later reached Ushuaia. After many delays due to bad weather the *Uruguay* finally reached Punta Arenas on January 28th, and Buenos Aires on February 8th.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

At a meeting of Council, held on Tuesday, March 14th, the following ladies and gentlemen were elected members of the Society :—

David Sinclair, M.B.
Wm. Lindsay Hatrick.
A. T. Aylmer.
George S. M'Nair.
Dugald Bannatyne.
John Bisset Verel.
George Sandeman, M.A.
Chas. Herbert Brown, M.A., LL.B.
Wm. Robert Ovens, of Peel.
Thomas J. Lindsay.
Robert Innes.
Chas. Edward Hamilton.
John Nisbet.
Dr. R. Home Henderson.
George Wm. Russell Millar.
Mrs. E. H. Mills.
Mrs. Mathieson.
Mrs. Hugh Auld.
David Gillespie.
Fred. William Martin.
Miss Howden.
Alan L. Menzies.
Miss C. Fenton.
Rev. W. S. Sutherland.
Miss Christie.
William Kerr, J.P., F.E.I.S.
Miss A. L. Forbes.
Miss Muriel Campbell.
Elliot W. D. Roddick.
George Aimers Barclay.
Webster Brown, C.E.
George Thomas Hobart.
Fred. C. Kennedy, C.I.E.
Ewen Cameron.

Lectures in March.

At Aberdeen, on the 13th March, Mr. S. Turner delivered an address on his expedition to the Altai Mountains, Siberia. Mr. John Clarke presided. On the following dates Mr. Turner repeated his address before our Dundee, Edinburgh, and Glasgow centres. Professor J. Yule Mackay occupied the Chair in Dundee, and Mr. J. G. Bartholomew in Edinburgh.

On Thursday, 23rd March, in Dundee, in the absence owing to illness of Mr. St. Hilaire Belloc, Mr. Shackleton delivered an address on "The Antarctic." Mr. J. C. Buist occupied the Chair.

On the 28th and 29th March, Dr. Tempest Anderson addressed the Society in Edinburgh and Glasgow on "The Volcanoes of the Lipari Islands."

GEOGRAPHICAL NOTES

Asia.

The Expedition to Western Tibet.—A small party, consisting of Captain Rawling, the leader, Captains Ryder and Wood, and Lieutenant F. M. Bailey, elder son of Colonel Bailey, our late Secretary, was sent by Colonel Younghusband to explore the great western province of Tibet. The party started from Gyangtse on October 10, and returned to Simla early in January after a most successful expedition. The expedition throughout met with a most friendly reception from the sparse population. Most of the inhabitants had never seen Europeans before, and they showed the greatest interest in the dress and appearance of the travellers. The Miriam-La, the watershed between the Brahmaputra and the Sutlej, was crossed at the end of November. It is 16,600 feet above the sea level, but, though snow was falling, the pass was easily surmounted. The great Mansarowar Lake was carefully explored for the purpose of clearing up long-standing controversies regarding it. There was found to be no flow at the outlet, and a rise of 3 feet would have been necessary for the stream to run. But the local Tibetans asserted that in the rains and when the snow melts—that is, for some four months of the summer—there is an outflow. A mile or so down the channel in the direction of the next lake, known as the Rakas Tal, a hot-water spring was discovered. The Rakas Tal was frozen over, and had no outflow into the Sutlej, but the Tibetans stated that a stream used to run from it in past years. The result of the exploration is therefore to place the source of the Satlej far more to the west than has been supposed. In the course of the journey to the British frontier, which was reached on Christmas Eve, the party had to cross the Ayi-La, 18,400 feet high, amid falling snow. After crossing this pass, the march for two days was made through a remarkable expanse of baked mud-flats, intersected in all directions by deep cañons. Subsequently the mud gave place to rock. The Sutlej there flows through very broken country, and some of the ravines are 2000 feet deep, and with very precipitous sides. The expedition definitely proved that there is no peak at all approaching Mount Everest in height.

Irrigation in Mesopotamia.—Sir William Willcocks has recently returned from Mesopotamia, where he has been travelling in order to study the question of irrigation. Sir William states that the Tigris and the Euphrates have apparently enough water to allow of the perennial irrigation of five million acres and to keep navigation open to the sea. The hydraulic problems are not so hard as those on the Nile, but great precautions must be taken up to secure the canals against obliteration by silt, which has often ruined Babylonia. Sir W. Willcocks says he saw the Tigris in places only 140 feet wide and 6 feet deep, and the Euphrates 40 feet wide and 3 feet deep, although he measured the water entering Babylonia and found it 50,000 cubic feet

per second for the Tigris and 25,000 cubic feet per second for the Euphrates. All the existing canals in the Baghdad pashalik were discharging 500 cubic feet per second between them. The first work needed would be an irrigation and navigation canal, some 150 feet wide, joining the Tigris and Euphrates at Baghdad. This would be easy, as the Euphrates is about 15 feet higher than the Tigris.

Irrigation in the Punjab.—Instructions have been issued for work to commence forthwith upon the great irrigation scheme for the Punjab which has been sanctioned by the Secretary of State for India. The total cost will be 782 lakhs of rupees (£7,213,333), and it is hoped to complete the undertaking in about nine years. The Upper Jehlam and Upper Chenab Canals are to be taken in hand first, as the work on the third project, the Lower Bari Doab Canal, is easier, and the canal will be dependent for its water supply on the other two. The total area to be annually irrigated by these new works will be some two million acres, which will thus be protected from famine, and a large part of which, now sterile, will be opened up to irrigation. The scheme for converting the Wular Lake, in Kashmir, into a reservoir to feed these canals does not form part of the project actually sanctioned, but it can be taken in hand at any time hereafter as an addition, the estimated cost being only 49 lakhs of rupees. Its principal use will be to increase the supply of water available for irrigating the cold weather crops, which are especially important in the Punjab.

Africa.

Exploration of Lake Tanganyika.—According to *Nature*, the Committee for the exploration of Lake Tanganyika has received news of the progress of the survey from their agent, Mr. W. A. Cunnington, who left England in March of last year (cf. this *Magazine*, xx. p. 159). Mr. Cunnington proceeded by the Zambesi and Shire route, and was well received at Zomba by Sir Alfred Sharpe, who granted him the assistance of two native collectors. As Mr. Cunnington passed up Lake Nyassa he investigated this lake in order that he might be able to compare its fauna and flora with that of Tanganyika. He was able to make a considerable number of tow-nettings from different parts of the lake, and obtained a large amount of the characteristic phyto-plankton, in addition to zoo-plankton, consisting chiefly of Copepods, Cladocera, and insect-larvæ. The temperature of the water of Lake Nyassa was observed to seldom fall below 70°, while at 76 fathoms below the surface it was observed to be about three degrees higher.

Mr. Cunnington arrived at Karonga at the head of Lake Nyassa at the end of June 1904, and travelled on to Tanganyika by the Stevenson road. At Ujiji he obtained a dhow, which enabled him to make his stay at different places on the lake longer or shorter, according as he found much or little to collect. He reports that he has obtained a good series of fishes and many fresh-water crustaceans. So far as his present observations go, he finds that there is a very striking resemblance between the vegetable life of Tanganyika and that of Nyassa.

The East Africa Protectorate.—The report on the East Africa Protectorate for 1903-1904, prepared by Mr. Hobley, the Assistant Deputy Commissioner, has been published as a Parliamentary paper (Africa No. 5, 1904, Cd. 2331). Mr. Hobley, in the general remarks prefixed to his report, says that, with the exception of certain small punitive measures, peace has reigned throughout the country. The total revenue of the protectorate was £108,857, and the total expenditure £418,877. Imports show a decrease of £96,293, but this large sum is due mainly to the difference in Government imports. Exports show a rise of about £12,000. On this point Mr. Hobley says:—"This growth is the more satisfactory as we have had to contend against a serious diminution of ivory amounting in value to about £8000, which is about a third of the whole value exported. For some time past laws have been in force restricting the slaughter of elephants. Their first effect was to put into circulation the hoards of buried ivory existing among natives, and regarded by them as almost equal to bullion. Now that these hoards are practically exhausted, the existing legislation, while preventing the destruction of elephants—an object with which all must sympathise—cannot but seriously hamper the ivory trade. The shrinkage in ivory has, however, been more than counterbalanced by the favourable development shown in the export of mangrove bark, india-rubber, potatoes, hides, and copra, to which it is hoped that cotton, fibre, ground nuts, and other commodities may soon be added."

In regard to experimental agriculture and stock-raising, the report states that during the year under review the efforts of the newly established Agricultural Department have been mainly directed towards the establishment of two experimental areas, one at Nairobi and one at Naivasha, and to the examination of the country with the view of ascertaining the relative suitability of the various districts for agriculture and stock-raising. It is unfortunate that the first season during which agricultural experiments have been made should have been an abnormally dry one—a fact which has largely contributed to the partial non-success met with in the production of certain crops, and which has made the authorities chary of accepting the results of many experiments as final. The following crops have been pre-eminently successful:—Maize, millet, wheat, barley, lentils, fenugreek, linseed and native beans, cotton, clover, rye grass; Lucerne and Egyptian clover moderately so. English wheat has made little headway, and oats have grown perhaps too luxuriantly. The crop of potatoes, which are extensively cultivated by the white settler, has been poor everywhere, but two crops can be produced, and Mr. Linton, Director of Agriculture, is of opinion that in an ordinary season a profit of at least £2 per acre should be realised on each crop. At present, however, the market is uncertain, and transport expensive. The freedom from this latter disability enjoyed by such products as coffee, rubber, and fibre, should obtain for them a prominent position in the agriculture of the country. Competent judges appear to agree in thinking that parts of East Africa possess infinite possibilities as a stock-raising country, though it is impossible at present to make any definite statement on this point. From Naivasha westwards grazing

is usually abundant. To develop this industry it will be necessary either to introduce fresh stock or to improve the native breed by crossing.

The report also contains a reference to sleeping-sickness, and to the species of tsetse-fly, upon which its distribution has been shown to depend.

The position of British shipping is stated to be unsatisfactory. The passenger trade up the coast is increasing, but most of it is in the hands of German and Austrian lines.

The Kismayu Concession.—The British Government has ceded to Italy a strip of territory on the Kismayu roadstead. The concession is to comprise an area of five acres and a sufficient frontage on the shore to the south-east of the British landing-place. Kismayu, it will be remembered, lies to the extreme south of the Italian Protectorate, and is the only safe harbour along that portion of the coast. Italy's object in leasing the territory is to have a practical landing-place for the purpose of trading with the interior of her own territory. The lease is to be for a period of thirty-three, sixty-six, or ninety-nine years, according to the amount of money spent by Italy during the first ten years of the period on the construction of the necessary landing facilities and buildings.

The Macmillan Expedition.—As already recorded in these pages (xx. p. 433) Mr. W. Macmillan and his party last year explored the southern boundary of Abyssinia, and investigated the connection of the rivers near Lake Rudolf with the Nile system. On their return in July to Khartum and Cairo another trip into Uganda was arranged, from which the party has recently returned. Leaving Mombasa in the middle of September, the explorers proceeded to the Athi plains and thence from Eldoma Ravine across the Gwasongishu Plateau to Mount Elgon. Mr. Macmillan is now organising a further expedition up the Blue Nile in order to establish a commercial river route between Abyssinia and the Sudan, and has had built in Norway a flotilla of specially designed wooden vessels for the navigation of the rapids. It is expected that a start will be made during the present month.

Lieut. Boyd Alexander's Expedition.—Further letters have been received from the members of the Boyd Alexander Expedition, which at the date of the letters was in the eastern provinces of Northern Nigeria, giving particulars of the work accomplished up to the end of last year, and indicating Lieutenant Boyd Alexander's plans for the future. Naturally there are references to the great loss which the expedition sustained in the death of Captain Claud Alexander, who died on November 13 at Maifoni, near Lake Chad. His death is the one serious misfortune which has attended an otherwise entirely successful expedition. The survey begun at Ibi has been completed to Kuka, on the western shore of Lake Chad, while very interesting collections illustrating the zoology of the districts traversed have been made. But the most

important work undertaken in December was an excursion in one of the steel boats in the western part of Lake Chad, made by Lieutenant Boyd Alexander and Captain Talbot, who found that for a distance of thirty miles from the shore the lake was little more than a shallow marsh, studded with islands half under water. The average depth of the water was only some twelve or eighteen inches, and the deepest sounding taken was four feet. The numerous islands are covered with a rough grass, which affords pasturage to the cattle of the Buduma—a timid folk, who invariably fled on the approach of the strangers in their unaccustomed boat. These lake dwellers have themselves large numbers of canoes, from ten to twelve feet long, which greatly resemble the gondolas of the Venice canals. Lieutenant Boyd Alexander's investigations would seem to indicate that the volume of water in Lake Chad is rapidly declining, and also that the lake is moving rapidly northwards; but the range of observation is as yet too small to enable any definite conclusion to be reached as to whether this vast inland sheet of water is really drying up, as has been suggested by some of the French officers who have visited it.

As to the future plans of the expedition, Mr. Talbot left his companions to return home on the completion of the survey of the lake, and has arrived in London, but Lieutenant Boyd Alexander, with Captain Gosling and José Lopez, the Portuguese collector, were to start about the middle of January on the long and arduous journey to the east coast. Lieutenant Boyd Alexander had hoped to transport the expedition across the lake, but its extreme shallowness made this project impossible, and he had decided to send the boats over very lightly laden, while himself taking the bulk of the loads round to the mouth of the Shari by land. Thence, if no difficulties were raised by the French authorities, he proposed to proceed through the upper part of the French Congo Colony and through the Congo Free State to Ruwenzori, on the borders of the Congo State and the Uganda Protectorate, from which district the rest of the journey to the east coast would be comparatively easy. If nothing intervenes to prevent this plan being carried out, the expedition will have crossed Africa from west to east by a new route, and will, no doubt, bring back very valuable collections illustrating the fauna of the different regions through which their route will lie.

America.

The Geography of Bolivia.—We have received an interesting and comprehensive pamphlet, entitled *Bolivia*, and published by the International Bureau of the South American Republics, which contain a large amount of information in regard to this republic, is copiously illustrated, and furnished with an index and bibliography. As regards area Bolivia stands third in the list of South American republics, Brazil and Argentine being the first and second respectively, and it is larger than any European country with the exception of Russia. But the population is very small, being estimated at 1,816,271 in 1900, which gives a rate of only 0·99 inhabitant per square kilometre, the smallest population per square kilometre

of any of the South American republics. As regards distribution, about 25 per cent. of the population inhabit the towns, the remaining 75 being rural. As regards climate, Bolivia can be divided into three zones—the region of the *yungas* or hot valleys, the *valles* or valleys, and the *punas* or cold lands. The first lies between sea-level and an altitude of 1688 metres, the second between this height and 3058 metres, while the puna area extends up to 4787. The region of perpetual snow varies from 5000 to 5260 metres according to the watershed. In the yungas the climate is spring-like throughout the year, the mean annual temperature varying from 22° to 19° C. (71·60° to 66·20° F.). There is no winter, humidity is constant, rainfall abundant, and the soil is fertile, producing tropical fruits of all kinds. When rain has been scarce the heat in this region is, however, severely felt. In the valles the temperature is mild, varying from 19° to 14° C. (66·20° to 57·20° F.). Rain lasts from November to March, the winter is very mild, the climate is healthy, and the soil produces cereals, all kinds of vegetables, and many fruits. In the puna there are only two seasons, autumn and winter. The atmosphere is dry and cold, the temperature varying from 14° to 2° C. (57·20° to 35·60° F.) according to the height. Here the soil in the lower parts produces certain kinds of tubers, and also good pasture. In the uppermost regions of this belt the soil is barren, and precipitation always takes the form of snow or hail. Throughout the country the winter months are May, June, and July, spring extends from August to September, summer from November to January, and autumn from February to April. The atmosphere is always heavily charged with electricity, and electrical storms are frequent. It is estimated that only about a twenty-fifth part of the land available is under cultivation—that is, about 4,000,000 hectares out of a possible 100,000,000, and even this is only partially utilised, and that by primitive methods. Owing to the diversity of the topography, and the existence of the climatic zones described above, a great variety of crops could be raised, and the soil is naturally rich and capable of easy irrigation. It may be calculated that the country would support about 28,000,000 of people, in addition to those at present found in it.

Australasia.

Exploration in New Guinea.—Mr. A. E. Pratt, who lately returned to England from a two years' expedition in the remote interior of British New Guinea, chiefly along the Owen Stanley Range, sailed on February 28 on a new scientific expedition, which is expected to last for two and a half years. Mr. Pratt, accompanied by his two sons, proceeds direct to Batavia, where he will make final arrangements for his journey. After conferring with the Dutch Government officials he will cross to Dobo, the chief town of the Aru Islands, a group unknown to Europeans. After making collections there the expedition will cross to Dutch New Guinea and will immediately strike into the interior with the object of reaching the highest possible point of the Charles Louis Range, a snow region running east and west of Dutch New Guinea never before ex-

plored by white men. Valuable geographical results are expected, and a map will be made, but the special work of the expedition will be the collecting of natural history specimens.

Antiquity of Man in Victoria.—In connection with the review of Mr. Howitt's book on the Australians in last month's issue (p. 165), it is of interest to note a paper by Professor Gregory on the Antiquity of Man in Victoria (*Proc. Roy. Soc.*, Victoria, xvii. 1). Mr. Howitt is of opinion that there is evidence that man existed in Victoria during, at least, the newer volcanic era, but Professor Gregory's careful examination of the somewhat scanty evidence which exists leads him to doubt this. Professor Gregory, indeed, makes it clear that as yet there is no satisfactory geological evidence that man has been resident in Victoria for any prolonged period. The point is of special interest, because the most plausible view of the origin of the Tasmanians and Australians is that the Tasmanians were formerly spread over the Australian continent, and were driven out by the influx from the north of the present aborigines, who were probably derived from a black Caucasian stock, though they may to some extent have intermarried with the race which preceded them on the continent. If this be so then, as Mr. Howitt points out, it means that the continent of Australia must have been inhabited by man for a very prolonged period, but as yet there is no evidence of this prolonged occupation forthcoming, so that meantime there is a want of harmony between the views of the anthropologists and those of the geologists.

Polar.

Scottish Antarctic Expedition.—At a recent meeting of the Edinburgh Geological Society, Dr. Pirie, of the above expedition, described the rocks occurring in the South Orkney Islands. The rocks contain fossils which prove them to be of Silurian age. The finding of sedimentary rocks in this locality shows that there must once have been a much greater extension of land in the south-western part of the South Atlantic.

The French Antarctic Expedition.—On March 4 news came of the safe arrival of the *Français* at Puerto Madryn, in the Argentine Republic. As we intimated last month, the *Uruguay* failed to obtain any information of the movements of the *Français* at Wiencke Island (cf. also p. 209), and some alarm had been expressed as to the safety of the expedition. These fears have happily proved uncalled for. The following telegram has been received from Dr. Charcot:—

'We wintered on Wandel Island, which enabled us to carry out all the scientific work of the expedition under favourable conditions. The question of Bismarck Strait was solved as the result of an expedition through it. We reached Alexander I. Land, but found it unapproachable on account of the ice. We touched at and explored several unknown points in Graham Land. In spite of our running aground and sustaining a serious leak on a coast discovered by us.

we were able to continue our voyage, and to determine subsequently the contour of the external coast of the Palmer Archipelago. All the members of the expedition are well."

The accompanying sketch-map will make clear the work carried out by the *Français*. It will be recollected that both the *Belgica* and the Swedish Expedition investigated this region, but, notwithstanding the efforts of both, there are still many blanks to be filled. Some of these have apparently been obliterated by the work of Dr. Charcot and his party. Thus they have apparently proved that Bismarck Bay is really a channel or strait, though as yet we do not know in what direction it runs. Again, the relation of the coast of Graham Land to Alexander I. Land (which is not shown on the map, but lies considerably further south and slightly west of Graham Land), has hitherto been unknown; but as the *Français* apparently followed the coast of Graham Land southward, it is possible that this problem has been solved. Finally, while the coast-line of the inner side of the islands forming the Palmer Archipelago, is, as shown on the map, already known and mapped, the outer coast-line has been hitherto unknown. It is satisfactory to know that, bit by bit, the boundary of the unknown in the Antarctic is being driven further and further back.

Sketch Map of Region Explored by the French Antarctic Expedition.
(NOTE.—Gerlache Channel is also called Belgica Strait.)

GENERAL.

The Meeting of the British Association.—The annual circular for the meeting during the coming summer has now been issued, and gives full particulars as to fares, dates of sectional meetings, and the officers of the Association. The president of Section E (Geography)

will be Admiral Sir W. Wharton, K.C.B., the vice-president, Mr. G. H. V. Melvill, and the secretary, Mr. F. Flowers. Among the lectures there will be one on the Victoria Falls and one on the Zimbabwe Ruins of Rhodesia. The following notice, as regards the membership of the South African meeting, is quoted from the official circular:—

"Members who propose to attend the meeting in South Africa are requested to send in their names to Mr. H. C. Stewardson, Chief Clerk of the British Association, Burlington House, London, W., not later than May 31, 1905. On receipt of their subscription, they will receive (1) a voucher, entitling them to a reduction of twenty-five per cent. on passages booked at the office of the Union-Castle Steamship Line (3 Fenchurch Street, London, E.C.); and (2) a railway certificate, entitling them to a reduction of fifty per cent. on railway fares in South Africa, during the visit of the Association. A limited number of *free passes* having been granted for that period by the railway administrations in South Africa, the Council of the Association will assign these to members who, by priority of application and order of seniority from the date of their election, shall become entitled to this concession. Associates of *former years* who are accepted by the Council as full members, on their application before May 31, will be included in this category and thereby participate in the advantages of membership.

"No new members or associates will be enrolled until the reunion of the Association at Cape Town on August 15, with the exception of those who, on written application to the Council, are approved as members of the Association entitled to receive the privileges accorded by the steamship and railway authorities. Such application must be made not later than May 31."

Magnetic Survey of North Pacific.—In a letter to *Nature* for Feb. 23, Dr. L. A. Bauer gives a full account of the contemplated magnetic survey of the North Pacific Ocean which is to be undertaken by the Department of International Research in Terrestrial Magnetism, under the auspices of the Carnegie Institution. If the proposed scheme be successfully carried out, it is hoped that the survey will be ultimately extended to cover other ocean areas. The present plan, in brief, is to charter a wood-built, non-magnetic sailing vessel of about six hundred tons displacement, which, starting in summer from San Francisco, shall pursue a clock-wise spiral course embracing the whole of the North Pacific Ocean. The total length of the course planned is about 70,000 knots, but the details may be modified, if this is found desirable, during the progress of the survey. It is expected that the entire work of observation and deduction will be accomplished in three years, and the annual outlay during this period is estimated at about 12,000 dollars. The region to be surveyed contains a sufficient number of magnetic observatories to furnish the necessary corrections to be applied to the magnetic elements, for continuous records of the required magnetic variations will be available from the following stations:—Sitka, Mexico, Honolulu, Manila, Shanghai, Tokio. In addition, it is hoped that there may be soon a magnetic observatory in California or its vicinity for lending effective co-operation, while, as already recorded in these pages, the German Government has decided to continue its magnetic observatory at Apia. It is not anticipated that the result of

the survey will be to show any marked irregularities in the distribution of the earth's magnetism over the deep waters of the Pacific, but it is believed that in the neighbourhood of the islands and along the coasts distortions and irregularities will be revealed. With the aid of the detailed magnetic survey of the United States and Alaska, opportunity will therefore be afforded of studying the effect of the configuration of land and water upon the distribution of the magnetic forces.

Professor Adolf Bastian.—The death is announced of Dr. Bastian, Director of the Berlin Museum für Völkerkunde. Dr. Bastian was a great traveller, and at the time of his death, in spite of his advanced age—for he was in his eightieth year—was engaged on a scientific journey in Trinidad. Professor Bastian was the author of many scientific books, among which may be mentioned *Die Völker des östlichen Asiens*, and *Die Kulturländer des alten Amerika's*.

The Influence of Caverns on Topography.—In *Science* for January 6, Professor Israel Russell puts forward a suggestion as to a possible effect produced upon the surface by the influence of caverns and underground fissures. He points out that in the general case limestone is susceptible alike to the influence of chemical and mechanical erosion, so that in most regions which have been stable for a prolonged period, and subjected to marked erosion, there is a tendency for limestone rocks to form depressions, owing to the fact that they have yielded more readily than the surrounding rocks to the agents of erosion. But there are exceptions to this rule, and Professor Russell describes two outstanding ones. These are the Rock of Gibraltar and Mackinac Island in Lake Huron. Mackinac Island has a circumference of about nine miles, and rises to an elevation of 317 feet above Lake Huron. The depth of water within a mile of its shore is from 150 to 200 feet, so that the island rises to a height of over 500 feet above the lake floor. The island is composed of limestone, which dips very gently to the south. A circumscribed patch of the same limestone occurs on the neighbouring peninsula of St. Ignace, but elsewhere the rock has been deeply denuded, the depressions so formed being now filled by the waters of Lakes Michigan and Huron. Gibraltar, again, rises 1349 feet above the surface of the Mediterranean, which in the vicinity of the peninsula is from 300 to 600 feet deep. The length of the promontory, as is well known, is about $2\frac{1}{2}$ miles, and the width is from 550 to 1350 yards. It is composed mainly of highly inclined limestone, and as a patch of the same limestone occurs on the African side of the Strait, it is evident that the Rock is the remnant of a formerly extensive formation. Both Mackinac Island and the Rock of Gibraltar resemble one another in that they are composed mainly of fissured and cavernous limestone, which is in part brecciated, and thus especially favourable for the downward percolation of water. Professor Israel suggests that the origin of both may be the same—that is, that it is due to the fact that the surface water passes inwards owing to the fissures of the limestone, and thus loses its power to mechanically erode. If the rocks which once surrounded the

two elevations were in each case less highly fissured, then they would be more rapidly denuded by the action of surface streams, and the result would be to leave the cavernous rocks in high relief.

Commercial Geography.

West Indian Agriculture.—During the month of January the fifth Congress of West Indian Agriculturists was held at Port-of-Spain, Trinidad, and in his presidential address Sir Daniel Morris gave an interesting account of the changes which are taking place in the economic conditions of the islands. Though, when considered in the aggregate, sugar must still be regarded as the backbone of the industries of the islands, yet in some of them it has already become of comparatively little importance. Trinidad is now a cacao-producing island, its exports of this commodity having already risen to the value of a million sterling per annum. In Grenada the yearly export of cacao is valued at £250,000, and in Jamaica at £80,000. In several of the islands cotton has also been successfully re-established, and good prices for the raw product have been obtained in the Liverpool market. The value of the export trade in fruit is already greater than that in sugar, while of other industries tobacco, rubber, sisal hemp, and fish-curing are developing.

The Simplon Tunnel.—On Feb. 24 the actual junction of the galleries of this tunnel was effected, when the accumulated hot water on the Swiss side escaped into the south gallery, and was discharged into Italy. The junction was effected at a point 6 miles 791 yards from the north entrance. It is expected that before very long the permanent way will be laid, and the line opened for traffic. The delay in the completion of the tunnel has been due to the unexpected difficulties encountered, especially to the springs of hot water. We have previously discussed here (xx. p. 87) the possible effect of the tunnel on the trade of Central Europe, and the various schemes which have been proposed for modifying the routes which lead to it. The French Government has now decided, it is stated, to adopt the Faucille project—that is, to tunnel through the Faucille Pass in the Jura, and construct a new Franco-Swiss line between the departments of Ain and Jura, connecting Lons-le-Saulnier and Geneva. It is hoped that this new line, in combination with the Simplon, will enable France to take a more important part than hitherto in the traffic with Italy, and also will enable her to obtain a larger share in the trade between Switzerland and the surrounding countries and America, by means of the French ports.

NEW BOOKS.

EUROPE.

England and the English. By Dr. Carl Peters. Pp. 400. London: Hurst and Blackett, Ltd., 1904. *Price 6s.*

The average Briton is so accustomed to being abused by foreigners that—in spite of his proverbial self-satisfaction—he will get an agreeable surprise when he

finds so distinguished a foreigner as Dr. Carl Peters awarding almost unqualified praise to us and our institutions. It is with a pleasant feeling that at last we have found some one who really understands and appreciates us, that we lay down this most interesting volume! Like a true German, Dr. Peters has evidently studied his subject thoroughly, and it may well be that many a Briton born and bred will glean a considerable number of items of information concerning our manners and customs from our kindly critic. Another point which we must note is the discrimination with which he touches the weak spots in our armour. Where he sees cause to blame, he does so with justice and restraint. Many things which we take as a matter of course he, as an outsider, has observed, and now lays before his audience.

For instance, every Englishman takes his daily paper as much for granted as his dinner, and will probably be somewhat amused when he reads that "Everybody reads his newspaper in England, nay, generally two, a morning and an evening one." Of course he does! Does not the true Englishman feel seriously aggrieved if he is deprived for one morning of his own specially favoured daily? And in the same chapter the tribute to an Englishman's instinctive and almost unconscious patriotism, his ineradicable sense of the vast superiority of England and the English over every other nation, may give rise to something the same feeling of slightly amused surprise. Yet we incline to think that the paragraph (p. 201) ending, "'I am English' is still for this race the proudest expression of individual consciousness," shows more insight into our national character than we have ever before met with in a foreigner.

Altogether we have to thank Dr. Peters very heartily for presenting to his fellow-countrymen such a fair-minded and accurate picture of our daily life and customs. We would like also, if it be permissible, to congratulate him on his command of the English language. This book should prove particularly interesting to members of our Society, as its author lectured to us in 1891 on his Uganda Expedition.

Handbuch der Wirtschaftskunde Deutschlands. Herausgegeben im Auftrage des Deutschen Verbandes für das Kaufmännische Unterrichtswesen. Vierter Band. Leipzig: B. G. Teubner, 1904. Pp. 748. *Price M.* 18.

To compile such a large mass of information as is contained in this work numerous collaborateurs have been necessary, and to comment adequately on its contents would be impossible within any reasonable limits of space. In this single volume the industry of Germany is set forth in general outlines, together with foreign commerce, wholesale and retail trade, communications by sea, river, and land, money and credit, associations for the promotion of commerce and industry, besides many supplementary subjects. The foreign commerce of Germany has made great strides, as is well known. Between 1894 and 1899 the value of the exports rose by 42 per cent., an increase only surpassed in the United States, and in the total trade of the world Germany ranks second only to Great Britain. Great Britain is the chief of Germany's customers, and furnishes the largest proportion of her imports. Owing, then, to the importance of the production and trade of Germany, a thorough description of them must be of general interest, especially in this country; and, if the other volumes are as full of detail as the present one, this work will be a mine of information for all who are interested in the subjects it treats of. Excerpts cannot be selected from such a mass of interesting material. It may be interesting to note, however, as fiscal questions are now much discussed, that Dr. van der Borght, who writes the introduction, considers the gradual lowering and eventual extinction of customs

barriers to be theoretically the most desirable economic policy, but adds that the practical needs of the industrial systems of individual nations are often opposed to such a step.

ASIA.

Among the Burmans. By Henry Park Cochrane. New York: Fleming H. Revell Company, 1904. *Price* 4*s.*

Mr. Cochrane has resided for fifteen years in Burmah, and his position as a missionary during that time must have brought him in close contact with its people. His impressions, therefore, are those of direct personal experience. There is a certain want of order in the book, but the author succeeds, nevertheless, in giving an interesting account of the country and its people, their customs and everyday life. The last few chapters contain an account of the author's mission work. Mr. Cochrane does not think that Buddhism is becoming stronger than in former years, though, in his opinion, it is helped "by the friendly attitude of the provincial government towards the religion of the land." He does not suggest that this is not in accordance with all the rules of good government, and in any case he may be congratulated on the results which he is able to show on behalf of the mission which he represents. There are a number of excellent photographs in the book.

Voyage au Yunnan. Par Gervais Courtellemont. Paris: Librairie Plon. Plon-Nourrit et Cie., Imprimeurs-Editeurs, 1904. *Prix* 4 *frs.*

If there is little interest taken by the average Frenchman in his Eastern possessions, it cannot be for want of information about them, for of late years we have had a great number of books, many of them very interesting and instructive, dealing with all parts of French Indo-China. The work now before us, the latest of them, is published by the well-known Librairie Plon, and is from the pen of M. Courtellemont, who, some two or three years ago, made a tour through Yunnan on a mission partly political and partly economical. We may remark that we do not gather from the work what was the nature of the political object of the expedition. Indeed the secret was so well kept that it was apparently unknown to the French Consul-General at Yunnan-San, who naturally looked upon M. Courtellemont and his wife, masquerading as Chinese in the country under his charge, as extremely suspicious characters, and treated them accordingly, to their undisguised chagrin and even to the danger of their lives. M. Courtellemont complains that at one time the Consul-General "avait écrit de nouveau au vice-roi du Yunnan pour l'informer que le gouvernement français ne répondait pas des incidents qui pourraient surgir à mon sujet et le prier de me faire expulser." Whereupon a missionary friend, "le Père Le Guilcher était navré. 'Mais c'est une félonie,' me disait-il avec la plus vive émotion. 'M. François peut-il ignorer que, si vous aviez affaire à des mandarins mal intentionnés, vous seriez impitoyablement assassinés, à la première occasion, durant votre voyage de retour? Vous êtes à treize jours de la capitale, et c'est vous exposer à la mort d'agir ainsi.'" The story gives us an uncomfortable idea of how they do things in Yunnan.

Regarding the general qualifications of M. Courtellemont for a mission of either political or economical importance we regret to observe that, on his own

showing, he is a man of unusual ignorance and prejudice. Comparison of the French administration of Indo-China with that of the English in India is of course inevitable, and we cannot expect that all French travellers and critics will be as favourable as the Marquis de Barthélemy. But we did not expect that a French writer, in the beginning of the twentieth century, would have the courage to write the following sentences, which are taken from M. Courtellemont's preface to this work :—"La conception humanitaire que nous avons de la colonisation est bien différente de celle des Anglo-Saxons, exclusivement utilitaire, et si l'on établit un parallèle entre nos colonies et celles des Anglais, par exemple, on est forcé de constater combien est dure, par rapport à la nôtre, la manière d'opérer de ceux-ci. Au point de vue de l'hygiène des agglomérations urbaines, nous faisons largement tout le nécessaire. Eux, pour ainsi dire, rien. Pour l'assistance publique, la préservation des épidémies, même différence. Ici, des soins éclairés, un souci constant d'écarter tous les dangers ; là une négligence coupable et des mesures partielles insuffisantes contre les famines et autres fléaux que l'on s'habitue trop facilement à considérer comme endémiques." Either M. Courtellemont has never heard of or understood what the British, within the last ten or twenty years, have done in India alone to combat plague, famine, cholera, smallpox, drought, and the other scourges to which India is liable, or else he deliberately ignores them.

An impartial perusal of the book leads us to believe that it is a *bonâ fide* attempt to impress on France the necessity of pushing on the construction of railways in Yunnan, first with a view to develop the resources of the country, and next as a precaution against "nos rivaux, blancs et jaunes," *i.e.* the British, Chinese, and Japanese. With the former motive we have every sympathy and are in cordial agreement ; the latter only provokes a smile. We must add that the book is illustrated with some fairly good photographs, and is furnished with two very indifferent maps.

Through Town and Jungle: Fourteen Thousand Miles Awheel among the Temples and Peoples of the Indian Plain. By William Hunter Workman, M.A., M.D., and Fanny Bullock Workman. London : T. Fisher Unwin, 1904. Pp. 380. With Map and 202 Illustrations. *Price* 21*s*.

The well-known climbers Dr. and Mrs. Workman have spent the cold weather of three years in an exploration of the plains of India, mostly on bicycles, for the purpose of visiting the notable examples of ancient architecture. The result is a most able and attractive volume. The photographs in particular are a delight, both to the expert and to the ordinary reader. Most of them deal with the buildings in mass. But there are many, such as those at Hulabid and Somnathpur (near Mysore), where the minuter details of the elaborate surface sculpture are illustrated. Commencing in the south of India, where the fine gopurams are well illustrated, the route works northwards as far as Kashmir, and extends west and east from Kathiawar to Calcutta. Throughout the writers evince their acquaintance with the best architectural authorities, but they do not hesitate to differ from them on occasion. Nor are their views to be treated with anything but respect. They display a discriminating and well-founded enthusiasm which is admirable. As is natural, they devote special attention to certain of their "finds," photos of some of which are here published for the first time. Thus Koravangula and Somnathpur are generously illustrated, while Delhi is unrepresented. Bundi, which is well known, receives special attention, and the sanguinary story of Chitor is vividly told. Orissa too, of which the Muhammedan conquerer and spoiler declared "the

country is no fit subject for conquest but belongs to the gods," has proved a rich mine for our authors. There are many personal elements in the narrative. The possibilities, or impossibilities, of the different dak-bungalows are detailed. A line and a half, or less, usually suffices for an inventory of their furniture, and this is no doubt recorded for the benefit of later explorers. But in spite of all hardships, and cycle runs of over eighty miles in the day, with occasionally knee-deep rivers to ford, the authors never suffered from sunstroke, chills, or fever—a fact on which the lady is specially to be congratulated, and from which others interested in the field may draw encouragement. The book is one which we can heartily recommend to our readers as a vividly-written narrative of travel, the main object of which was to see and depict the wonderful architecture of India. From the strictly scientific point of view the expert may find slips in historical allusions, dates, and orthography, but they are few and trivial. The illustrations alone are sufficient to commend the book to Anglo-Indians.

Dans les Rapides du Fleuve Bleu. Par le Lt. de Vaisseau Hourst. Paris: Librairie Plon. Plon-Nourrit et Cie. Imprimeurs-Editeurs. 1904.

M. le Commandant Hourst is already well known to many readers by his interesting work *Sur le Niger et au pays des Touaregs*. In the book now before us he takes us to the upper reaches of the Yang-tze-Kiang, and gives us an amusing account of his adventures among the famous rapids of that river. The gunboat he had charge of was a rickety concern, nicknamed "the Soap-box" by his *confrères* in the English service; but by sheer dint of pluck and perseverance and seamanship, if such a word is applicable to manœuvres on the Yang-tze-Kiang, he was able to force it up the river to a point further than had ever been reached by gunboats before. In this he was ably assisted by his English pilot Plant, the value of whose services he cheerfully and generously acknowledges. The expedition took place in 1901-2, and he was in time to come in for some exciting adventures with the Boxers in Sze-chuan; for many readers this will be the most interesting and valuable part of the book. His sailor-like downrightness and vigour of speech must have been a surprise and a shock to the feeble Viceroy, whose policy was to do as little as possible, and when compelled to action, to buy the Boxers off. The presence of the plucky sailor and his three comrades probably saved the Christians of Cheng-tu from massacre; for he bearded the Viceroy in his den, and compelled him to take steps for the preservation of foreigners. Written in a breezy, cheerful style, the book is worth reading; it is embellished with some good photographs.

AFRICA.

The Assuan Reservoir and Lake Moris. By Sir William Willcocks, K.C.M.G., with translations in French and Arabic. London: E. and F. N. Spon. 1904.

This is the subject of a lecture delivered to the Khedivial Geographical Society in Cairo, in which Sir William Willcocks expounds his latest ideas—and many valuable ideas he has—on the further development of Egyptian irrigation. The success of the wonderful dam at Assuan, in whose design he had such a large share, has led to the consideration of further improving and regulating the flow of the Nile by raising the dam, and by turning the depression known as the Wady Rayan into a huge reservoir to hold the surplus water during the flood season, and release it again when the river is low and requires to be supple-

mented in Lower Egypt. The ancient Lake Mœris is now recognised as having occupied what is now the fertile province of the Fayûm, and the Wady Rayan, which is situated some distance south of the Fayûm, can be made into a new Mœris reservoir, the feasibility and utility of which are set forth in this booklet with all the knowledge and enthusiasm of the distinguished author. Since the great practical utility of the Nile barrages at Cairo and Assiut, and the great Assuan dam, have now been thoroughly established, many further developments may be looked for in the fascinating work of regulating and distributing the fertilising flood, so that Sir William's projects have every chance of realisation in the near future.

AMERICA.

Alaska. Vol. III., Glaciers and Glaciation. By Grove Karl Gilbert. Harriman Alaska Expedition. New York, 1904.

Mr. G. K. Gilbert, whose works on American geology are always so attractive, describes in this handsome and beautifully illustrated volume his observations made in 1899 while a member of the Harriman Alaska Expedition. This is only one of a series of volumes by different authors descriptive of the geology and natural history of the territory, and is devoted entirely to the glaciers and glaciation of that vast inhospitable region. The glacier belt includes three-tenths of Alaska, and the actual ice covers about one-tenth of this area, or from 15,000 to 20,000 square miles. In such a vast tract there are many hundreds, possibly more than a thousand glaciers, only a few of the more conspicuous of which have as yet received distinctive names. The author says that, although Alaska is as yet only imperfectly explored, enough is known to give it rank as the third great glacier district of the world, only surpassed in extent by Greenland and the Antarctic continent. Of the numerous glaciers visited and described he has much to say that is interesting and instructive. At page 52 an account is given of the "Hidden Glacier," a mile in width, with a gently inclined ice-front that slopes down to an alluvial plain nearly two miles long. This plain is punctured with numerous "kettle holes" resembling the "sits" that occur in mining districts where thick seams are being worked out, and Mr. Gilbert ascribes them to the melting away of the snout of the glacier which apparently extends under the plain for some distance beyond the visible ice farther up the valley. The waning glacier "was so reduced by the wasting of its surface near its end that the debris of its moraines, worked over by glacial streams, overspread the ice and buried a wide belt."

No general advance or retreat of the glaciers over the whole region explored during historic times is to be recorded. In some areas a general advance has occurred, and in others the ice has shrunk back as much as thirty miles within a century, but in the Pleistocene Age, or Glacial Period, Alaska, like other Northern countries, was affected by the prevailing severe climatical conditions. Among the features produced at that time much prominence is given to what are called "hanging valleys," or tributary valleys that enter at a higher level than the floor of the main valley, and show that the trunk glacier continued to wear down its bed after the branch glaciers had dwindled away. The volume is full of the fruits of new and fresh observation obtained at first hand on a vast region that has hitherto not been explored by trained scientists at all exhaustively, and should be studied by all who are interested in glacial phenomena, and the effects of flowing ice on the physiognomy of the solid ground.

GENERAL.

Wander-Years Round the World. By James Pinnock. With Maps and Illustrations. London: T. Fisher Unwin. *Price* 21*s. net.* 1904.

This is a book of jottings made by Mr. Pinnock, a Liverpool merchant, who after forty years of busy life took a pleasure-trip of two years and a half round the world. His tour was comprehensive, including the West Indies, Mexico, the South Sea Islands, Japan, Australia, New Zealand, India, and East Africa. The maps are good, the illustrations numerous and clear, the jottings have obviously been written by an intelligent and experienced man, and can be read with interest especially by any one proposing to take a similar holiday. The book, however, is only a guide-book, and must not be regarded as a first-hand authority. To take the Indian section alone, Central India does not include Rajputana, nor is Rajputana one native state, as the writer seems to imply: it is hardly accurate to say that Sir H. Lawrence was shot by a rebel soldier, and the Jains surely deserve fuller treatment than the mere statement that their religion is half-Buddhist and half-Hindoo.

Dodge's Advanced Geography. By Richard Elwood Dodge, Professor of Geography, Teachers' College, Columbia University, New York City. Pp. 333 + xix. Many Maps and Illustrations. Chicago: Rand M'Nally and Co., 1904. *Price* $1.20.

The editor of this book need not hope for any sale of it on this side of the Atlantic, at least in English-speaking parts. It may find acceptance in other parts, for it suggests to us, so far as our islands are concerned, the efforts of a book-learned foreigner. We are loth to apply the term "foreign" to anything that comes from "America," and can only trust that in other portions of the globe this comprehensive work will be found more in touch with local facts than it is here. The student who masters all there is in it has still, it seems to us, a great deal to learn. Neither a fairly close acquaintance with Scotland nor the latest authorities enable us to locate either "Glenariff, Scotland, where the highlands and lowlands meet" (though there is a Glenariff in County Antrim, Ireland), nor "Lima Glen, Scotland." "Keswick, Scotland" (p. 231) is not creditable to the editor, but is another indication that our author fails to recognise distinctions upon which some stress is laid here.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

Lhasa: An Account of the Country and People of Central Tibet, and of the Progress of the Mission sent there by the English Government in the Year 1903-1904. By Perceval Landon, Special Correspondent of the *Times*. With an Introduction by Colonel Sir Francis Younghusband, K.C.I.E. In 2 vols. Royal 8vo. Pp. viii + 414—436. With over 250 illustrations and 7 maps. *Price* £2, 2*s. net.* London: Hurst and Blackett, Ltd., 1905.

Antarctica: Two Years amongst the Ice of the South Pole. By Dr. Otto Nordenskjold. Medium 8vo. Pp. 628. With over 250 illustrations and 3 maps. *Price* 18*s. net.* London: Hurst and Blackett, Ltd., 1905.

The Unveiling of Lhasa. By Edmund Candler. Royal 8vo. Pp. xvi + 304. *Price* 15*s. net.* London: Edward Arnold, 1905.

To Lhasa at Last. By Powell Millington. Crown 8vo. Pp. x + 200. *Price* 3*s.* 6*d. net.* London: Smith Elder and Co., 1905.

Holy Himalaya. By E. Sherman Oakley, M.A. Demy 8vo. *Price* 5*s. net.* Edinburgh: Oliphant Anderson and Ferrier, 1905.

The Purple Land. By W. H. Hudson. Crown 8vo. *Price* 6*s.* London: Duckworth and Co., 1905.

With the Pilgrims to Mecca. By Hadji Khan, M.R.A.S., and Wilfred Sparroy. With an Introduction by Professor A. Vambéry. Demy 8vo. Pp. 314. *Price* 12*s.* 6*d. net.* London: John Lane, 1905.

Dai Nippon: The Britain of the East, a Study in National Evolution. By Dr. Henry Dyer. Demy 8vo. *Price* 12*s.* 6*d. net.* London: Blackie and Son, Ltd., 1905.

La Science Géologique, ses Méthodes, ses Résultats, ses Problèmes, son Histoire. Par L. de Launay. 8vo. Pp. 752. *Prix* 20 *fr.* Paris: Armand Colin, 1905.

Meteorologia Generale. Del Dott. L. De Marchi (Manuali Hoepli). Pp. vi + 156. *L.* 1. *c.* 50. Milano: Ulrico Hoepli, 1905.

The Masai, their Language and Folklore. By A. C. Hollis. With an Introduction by Sir Charles Elliot. With illustration and map. 8vo. *Price* 14*s. net.* Oxford: Oxford University Press, 1905.

The World of To-day: A Survey of the Lands and Peoples of the Globe as seen in Travel and Commerce. By A. R. Hope Moncrieff. Vol. I. Large 8vo. Pp. 279. *Price* 8*s. net.* London: Gresham Publishing Co., 1905.

Researches in Asia Minor, Pontus, and Armenia. By William J. Hamilton. 2 vols. John Murray, 1842.

Travels and Researches in Asia Minor, Mesopotamia, and Armenia. By William Francis Ainsworth, F.G.S., F.R.G.S. 2 vols. London: John W. Parker, 1842.

Travels in Little Known Parts of Asia Minor. By Rev. Henry J. Van Lennep, D.D. 2 vols. London: John Murray, 1870.

Caravan Journeys and Wanderings in Persia, Afghanistan, Turkistan, and Beloochistan. By J. P. Ferrier. London: John Murray, 1856.

A Journal of the Passage from India, by a Route partly unfrequented through Armenia and Natolia or Asia Minor. By Thomas Howel, M.D. London: C. Foster. N.D.

Voyage en Turquie et en Perse. Par Xavier Hommaire de Hell. 4 vols. Paris: P. Bertrand, 1854.

Relations de Voyages en Orient de 1830 *à* 1838. Par Aucher-Eloy. 2 parts. Paris: Librairie Encyclopédique de Roret. N.D.

Asie Mineure, Description Physique. Par P. de Tchihatoheff. 2 parts. Paris: Théodore Morgand, 1866.

Recueil de Voyages et de Mémoires. Publié par la Société de Géographie Tome Septième. Paris: A. Bertrand, 1844.

(*Presented by Mrs. Currie, Trinity Cottage.*)

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE GEOGRAPHICAL RESULTS OF THE TIBET MISSION.[1]

By Sir Frank Younghusband, K.C.I.E.

(*With Illustrations.*)

Though I shall tell to-night of a journey to the "Forbidden City," there is, I fear, little, strictly speaking, new that I shall have to say. My companions and myself were, indeed, the first Europeans to enter Lhasa for many years. Still, we cannot claim credit for having been the first of all, and all I can do is to corroborate and emphasise the work of former travellers, and especially of those hardy Indian explorers A-K, Sarat Chandra Das, and others, who had made such careful surveys and interesting notes, that some at least of our obstacles were removed.

Such corroboration is, however, very necessary, for an impression had of recent years grown up in Europe that Tibet was a wretched, poor, inhospitable country; and this is not what those few travellers, European and Indian, who had been to Lhasa before had described, nor is it actually the case. The northern part of Tibet, which is all that recent European travellers have seen, is indeed barren, uncultivated, and worthless, and this forms quite two-thirds of the whole. But Tibet is a large country—as large as the provinces of Bombay, Madras, and the Punjab put together, and there is a third part still remaining which is remarkably well cultivated, which is dotted over with thriving villages and the well-built and comfortable residences of the Tibet gentry. Taking it as a whole, then, and excluding the worthless desert portion, Tibet is probably fully as rich as Kashmir or Nepal. The valleys in which Lhasa, Gyantse, and Shigatse are situated, and the valley of the Brahmaputra, are neither barren plateaux nor yet narrow

[1] An Address delivered before the Society on March 8th. Published by permission of the Royal Geographical Society.

V-shaped gorges. They are flat valleys from four or five to as much as ten miles broad, covered with good soil, well irrigated and richly cultivated. This is the most important geographical fact which, though mentioned casually by former travellers, we were able to re-establish and confirm.

And with this fact clearly impressed upon your minds, let me now ask you to follow in the footsteps of the Tibet Mission in its journey from India to Lhasa. We unfortunately had to take our bodies there, and for the human body Tibet and Sikkim, through which we had to pass on the way into Tibet, are at certain seasons anything but attractive. You, however, need go there in mind only, and for the mind I do not know, in the whole realm of nature, any greater glories than Sikkim and Tibet afford. At the very outset of our travels was the sight which in all the world I consider the supreme—the view of Kinchenjunga from Darjiling, described by many travellers before, but by none better than by Mr. Douglas Freshfield in his recent book on this region. We had then to pass through as superb tropical forests as are anywhere to be met with, and, emerging on the high Tibetan tableland, it was our good fortune to live for a month in full view of the magnificent panorama of 150 miles of the highest peaks in the Himalayas, with the loftiest mountain in the world as the culminating object. Lastly, we had ever before us in the dim mysterious distance the Sacred City, of which so little was known, and entrance to which was barred by every obstacle which man and nature could raise; and while my military companions had constantly to think of how best to overcome the resistance we might encounter, we of the political service had continually with us the earnest desire and the ambition to lessen by all our powers of reasoning and persuasion the military resistance, and above all so to impress the people who were now first making our acquaintance, that on our departure their disposition towards us should be one of friendliness rather than hostility, and that they should no longer look upon us as people to be roughly and rigidly excluded, but, on the contrary, respected and welcomed.

What more inspiring task could any men be intrusted with? And while this is not the place to speak of the military and political work of the Mission, I may at least say that our objects *were* attained, and I may express my firm conviction that from this time onwards all European travellers will be the gainers for what the British Mission to Lhasa did in 1904. One only evil geographical result I foresee. This Society will have one less destination for the adventurous explorers of Great Britain, and the Sven Hedins of the future, like a fast-expiring race, will be driven back and back till they finally vanish from the Earth amid the Arctic snows. But for this misfortune not we only are to blame, but also and chiefly one of your own Gold Medalists, the great Viceroy of India to whose initiative the whole enterprise was due, and without whose constant support it could scarcely have been brought to a conclusion so disastrous for future explorers.

Our start from Darjiling in June 1903 was miserable enough. The monsoon was just bursting, the rain was coming down in cataracts, and all was shrouded in the densest mist. Few knew of the enterprise upon

which I was embarking, but a little knot of strangers who had assembled in the porch of the hotel had got an inkling, and shouted "Good luck" as I rode off, covered with waterproofs, into the mist to join my companions, Mr. White and Captain O'Connor, in Sikkim. And detestable though the rain was, there was still a large surplus of joy in riding through those wonderful Sikkim forests, day after day seeing fresh marvels of forest growth or flowery beauty. The mountain-sides were everywhere a wealth of tropical vegetation, rich and luxuriant. And here under the shades of the mighty giants of the forest grew the stately tree-ferns, often 40 or 50 feet in height, with fronds 10 or 12 feet long. All were in bright fresh foliage, and besides ferns of every graceful form and of the subtlest delicacy of tracery were variegated coloured plants, like calladiums, and closely connecting all together, and festooned from tree to tree, were creepers of every size, from the great elephant creeper whose leaves resembled elephants' ears, to light trailing vine-like tendrils lightly strung from bough to bough; while here and there, as some bright surprise, the eye would light upon the most perfect orchid, or other flowery marvel, which brought one to a halt in an ecstasy of enjoyment. Nor should I omit to mention the brilliant butterflies glinting past on every side. Seventeen different kinds did I count in the space of 200 yards in the Teesta valley; and in few other places in the world are to be found such a variety of rare butterflies, so many different orchids, and such a wealth of trees and flowers as in Sikkim. There are, I believe, over six hundred different orchids alone to be found here, and over sixty separate kinds of rhododendron.

Fain would I dwell longer on the attractions of this wonderful country, but it is with Tibet itself that we are chiefly concerned to-night, and thither I must without delay transport you. Just cross one pass, and all is changed. On the far side of the Kongra-lama pass not a tree is to be seen. If in some secluded nook a plant a foot high is met with, it is a curiosity. In place of the deep-cut valleys of Sikkim there are great plains ten or twelve miles wide. The sky is cloudless, and the view extended over many and many a mile. Here at Khamba Jong Mr. White had laid out a camp, and here we spent many delightful months, doing our best to bring to reason a people nearly as obstinate as ourselves, and between whiles making roving expeditions to distant valleys, geological investigations with Mr. Hayden of the Geological Survey, botanical trips with Dr. Prain of the Botanical Gardens in Calcutta, natural history expeditions with Captain Walton, I.M.S.; every day and every hour enjoying the charming summer climate, and, above all, the unrivalled panorama of the mighty Himalayas at the very culminating point of their grandeur, where all the loftiest peaks in the world were majestically arrayed before us. Captain Ryder, known to you for his journey in China, surveyed and measured all this wonderful region, and will, I trust, before long give you full particulars of his surveys. But who will ever be able to adequately describe the fascination of that glorious range of mountains? From sunrise to sunset the days were a continual delight. As I looked out of my tent in the early morning, while all below was still wrapped in a steely grey, far away in the

distance the first streaks of dawn would be just gilding the snowy summits of Mount Everest, poised high in heaven as the spotless pinnacle of the world. By degrees the whole great snowy range would be illuminated and shine out in dazzling, unsullied whiteness. Then through all the day it would be bathed in ever-varying hues of blue and purple till the setting sun clothed all in a final intensity of glory, and left one hungering for daylight to appear again.

And all was rendered doubly interesting from the history of its geological past, which Mr. Hayden was able to describe to me. He was indeed enraptured with the district from the geological standpoint, and a bed of fossil oysters he discovered there had more fascination for him than Lhasa itself. He was able, from the oysters, to accurately determine the age of the hills in this part of Tibet. According to him they were "recent," that is to say, not more than two or three million years old, and the main axis of the Himalayas was thoroughly modern, perhaps not more than a few hundreds of thousands of years old. In what to geologists are really ancient times Tibet was below a sea which washed around the base of the Himalayas—a mighty granite ridge which is constantly being protruded upward from the interior of the earth, and ever being worn away by the snowfall on its summit. Never have I been able to see Nature at work on such a mighty scale as here, and when the scientific results of Mr. Hayden's work in this region have been thoroughly investigated, I feel sure they will prove of the highest interest and value.

The Mission remained at Khamba Jong from July 7 to December 6, but long before the latter date we had discovered that our political objects would never be obtained until we advanced further into the country. A move on to Gyantse was accordingly ordered, and as a considerable body of troops, under the command of General Macdonald, was to escort the Mission, the line of advance was changed on to the Chumbi route.

Winter was now on us, and the difficulties which General Macdonald and his troops had to contend with can hardly be realised in England. But not even the rigours of a Tibetan winter were able to stop the advance of the little force of British and Indian troops.

Early in December we crossed the Jelap-la and descended into the Chumbi valley. At Yatung, the trade mart established under the old convention, a wall had some years ago been erected to exclude our trade, and beyond this our traders had so far never been allowed to pass. As we debouched on a bright frosty morning from the pine forest in which we had encamped for the night, we saw this wall built right across the road and high up the mountain-side on either hand. Whether we should have to fight our way through, or whether the Tibetan general would respond to the arguments I had used the previous day and gracefully allow us through, had yet to be proved, and General Macdonald used every military precaution. But, to our relief, we saw the great door in the tower standing open, and we were soon passing peaceably through the gate of Tibet, never, I hope, to be closed against us again.

We then emerged on to the main Chumbi valley, which, though not wide and open like the valleys we afterwards saw in Tibet Proper, is decidedly less steep and narrow than the Sikkim valley. Both in the valley-bottom and on the hillsides there was room enough for comfortable

Village near the Lingmatang Plain in the Chumbi Valley.

villages and cultivated fields. The people were very well-to-do, and, what was more satisfactory from our point of view, decidedly well disposed. They soon showed themselves to be keen traders, and must have made large fortunes out of us during last year. They are not true Tibetans, but are called Tomos. Nor is their valley, which is on the

Indian side of the watershed, considered a part of Tibet Proper, which is looked upon as extending only as far as the mouths of steep gorges we a few days later passed through in the upper part of the valley. The rainfall is only about half that of Darjiling, and the climate in general much superior.

The Mission remained three weeks in Lower Chumbi, while military preparations for a further advance were being made; and then in the very depth of winter, on January 8, we crossed the Tang-la, 15,200 feet high, on to the Tibetan plateau again. Never shall I forget that day. Reveillé sounded at the first streak of dawn, and as I looked out of my tent the very spirit of Frost seemed to have settled on the scene. The stars were shooting out sharp clean rays from the clear steely sky. Behind the great rugged peak of Chumalhari the first beams of dawn were showing out, but with no force yet to cheer or warm, and only sufficient light to make the cold more apparent. Buckets of water were, of course, frozen solid. The remains of last night's dinner were a hard solid mass. The poor Sikhs were just crawling out of their tents, so shrivelled with the cold it looked as though, if they shrivelled much more, there would be nothing left of them. The thermometer stood at 18° below zero, or just 50° of frost, and though this is not considered much in Canada and Siberia, and I dare say those who have just returned from the Antarctic would consider it pleasantly warm, I should remind you that 50° of frost at a height of 15,000 feet above sea-level is a very different thing from 50° of frost on the sea-level. At 15,000 feet, where the effort of breathing is a continual drain upon one's strength, the mere weight of the heavy clothes one has to wear in cold weather is a sufficient strain in itself. Any additional effort exhausts one immediately. And if it tries us Europeans, who are more or less inured to cold, how much more distressing must it be to the natives of India! and that they were able to march fifteen miles across the pass that day, and spend the rest of the winter, as they had to, immediately on the other side, at a height of but little under 15,000 feet, is, I think, a striking testimony to their powers of endurance and the high spirit which prevails among them. Colonel Hogge and the 23rd Pioneers most willingly faced this ordeal, and by this act of endurance proved once and for all to the Tibetans that their country was no longer inaccessible to us, even in the depth of winter.

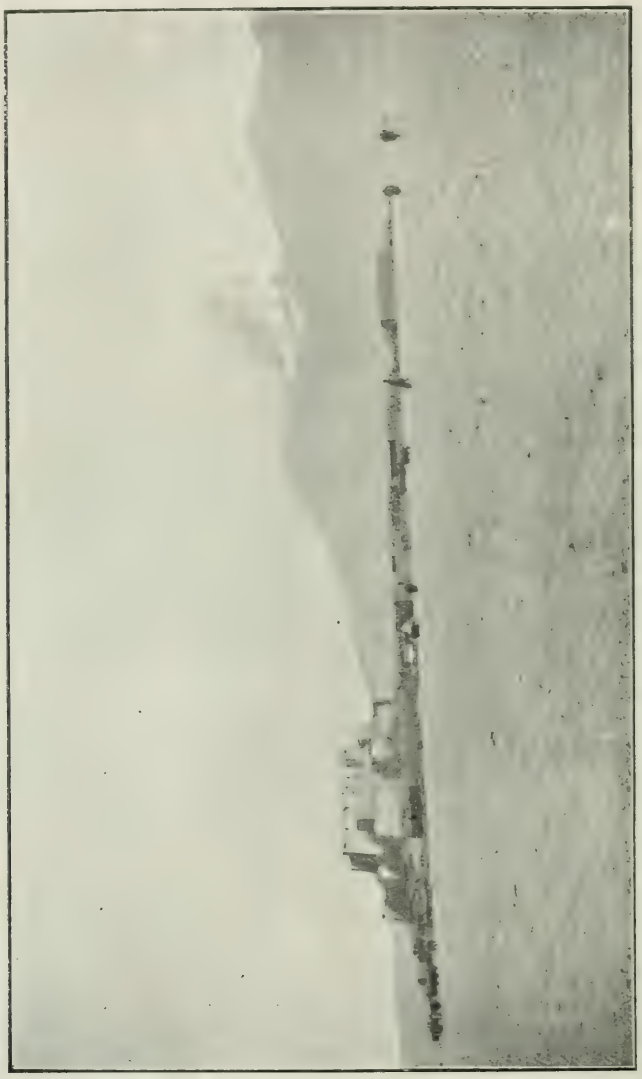
Here at Tuna more fruitless parley with the Tibetans ensued. They paid one or two visits to me, and once I rode over with Captains O'Connor and Sawyer to see them amid their own surroundings, to gauge their capacity, and to estimate the strength and direction of the various influences at work among them. It became sufficiently evident to us that the real control of affairs was in the hands of the Lhasa lamas, three of whom, one from each of the three great monasteries at Lhasa, were present on the occasion. The four generals whom we then met were amiable and polite enough. They repeated by rote the formula, "Go back to the frontier." But the impetus to obstruct came from the three lamas, who, with scowls on their faces, remained seated on the ground, showing not the slightest signs of civility or ordinary

politeness, and instigating the generals to detain us in the Tibetan camp till we would name a definite date for withdrawal. When I think of their rabid fanatical obstruction on that occasion, and compare it with the almost cordial reception we subsequently had in all the great monasteries and in the most sacred shrines before we left Lhasa, I cannot help feeling that we went a long way towards breaking down that barrier of exclusion which, set up by the lamas for their own selfish ends, has kept away from us a people who, when left to themselves, showed every inclination to be on friendly terms with us and indulge their natural instinct for trading.

But parleying with the Tibetans occupied only an insignificant part of my time at Tuna, and I had ample leisure to enjoy the magnificent natural scenery around us. Immediately before us was an almost level and perfectly smooth gravel plain, which gave a sense of space and freedom, and on the far side of the plain, ten or twelve miles distant, rose the superb range of mountains which forms the main axis of the Himalayas and the boundary between Tibet and Bhutan. They were an unceasing joy to me, and the sight of them alone was ample reward for all the hardships we had to endure. The sun would strike our tents at about seven in the morning. The sky would generally then be cloudless save for a long soft wisp of gauze-like haze, and perhaps a few delicate streaks of pink or golden cloud poised motionless on the horizon. And the great snowy mountains, in the early morning when I used to go out and watch them, instead of being sharp, clear, and cold, would be veiled in that blue, hazy, dreamy indistinctness which makes the view of Kinchenjunga from Darjiling so marvellously beautiful, and the hard stern mountains as ethereal as fairyland. The bare brown of the base of the mountains was toned down into exquisite shades of purple and pink, while the white of the snowy summits shaded softly into the cerulean of the sky above. On the plain, plump little larks and finches would be scurrying about in search of food. Now and then a little vole would be seen basking in the sun at the mouth of his hole. And over all there reigned a sense of peace and quiet, which made it hard to believe that only ten miles off, five of the highest lamas in Tibet were solemnly cursing us and publishing to the people round threats of attack upon our camp.

Nor was every day, nor the whole of each day, of this same peaceful nature. Almost invariably at ten or eleven a terrific wind would arise and blow with fury for the rest of the day. Mighty masses of cloud would come sweeping up from the direction of India. Snow would sometimes fall, and then for two or three days together we would be the sport of a terrific blizzard. The mountains would be hidden, and nothing would be visible but dull masses of fiercely driven snow, as fine and dry as dust, and penetrating everywhere. For days together the thermometer would not rise above 15°, even in the middle of the day. Our camp would be the very picture of desolation. It seemed impossible that the poor sentries at night would ever be able to stand against the howling storm and the penetrating snow, or that our soldiers would ever be able to resist an attack from the Tibetans under such terrific circumstances.

Then one morning we would find the snow-clouds had passed away from over us, and see the great peak Chumalhari emerging calm, strong, and irresistible from out of the mass of cloud still tossing wildly round its base. Below all seemed chaos. It was difficult to stand against the



Phari Jong, with Chumalhari, 24,300 ft.

driving wind; the dust and the powdery snow were still battling furiously around one and around the base of the mountain, and the birds were driven hither and thither. But towering above all the tumult below, serene and majestic, and looking prouder, loftier, and purer than ever, rose the great peak reverenced even by the unimaginative

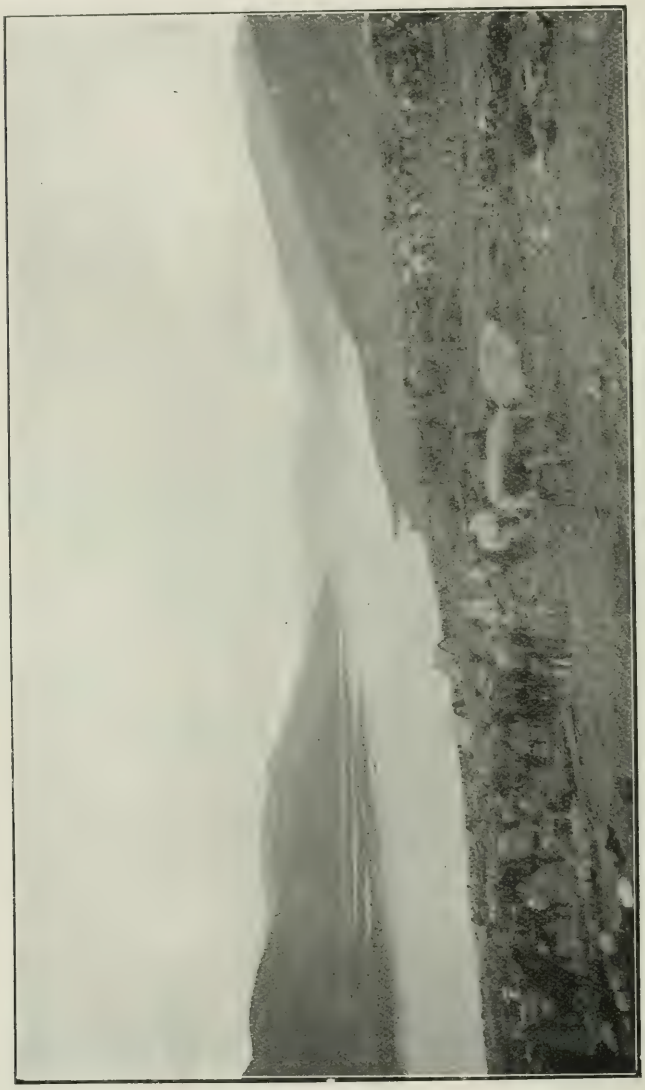
Tibetans; and above it lay the calm blue sky, illimitable in its restfulness and light—a sky of bright and liquid azure, through which one seemed able to pierce right into heaven itself.

Throughout January, February, and March the bitter winds continued, often accompanied by snow in blinding blizzards, through which the convoys and their escort had to force their way with perhaps even greater sufferings than fell to us. But gradually, as week by week went by, the temperature rose. The military preparations in rear were completed by General Macdonald, and early in April we marched down to Gyantse. Of the military incidents on the way I will say nothing. It was the deepest disappointment to me that fighting should have been necessitated, and the Tibetan generals were as little anxious for it as I was, but they had impossible orders from Lhasa—orders not to fight, not to negotiate, and not to let us proceed. Unless, therefore, we were prepared to abandon the whole object of the Mission, fighting was inevitable.

Arrived at Gyantse on April 11, we found a flat open valley five or six miles wide, dotted all over with flourishing hamlets and intersected by numerous water-channels. Round each hamlet, along the water-channels, and by the bed of the river were willow and poplar trees just showing signs of bursting into foliage. The banks were covered with masses of iris plants, which later on were to flower out into sheets of purple. The piercing cold of the Tuna uplands was left behind. There was only a slight touch of frost at night, while the days were beautifully fine and bright; and we were looking forward to a restful summer of peaceful negotiation, when suddenly ominous clouds began to collect around us, and early on the morning of May 5 we were awakened by wild shouts and firing, and, looking out of our tents, saw Tibetans firing into us through a wall only ten yards off. How Major Murray and his Gurkhas warded off the attack; how Colonel Brander defended the post for nearly two months against the Tibetans, who had now invested us; and how General Macdonald eventually returned with a relieving force, drove back the Tibetans, and captured the jong, has been told elsewhere. Geographically, the important point is that the refusal of the Tibetans to negotiate at Gyantse necessitated our advance to Lhasa. On July 14 we set out, much impeded by heavy rain, and soon set aside the delusion that Tibet is a rainless country. Well on till September we had frequent rain, and the size of the rivers and side streams was quite sufficient evidence that this part of Tibet receives—probably up the Brahmaputra valley—a quite considerable rainfall, say between 20 and 30 inches, at a rough guess.

We crossed the easy Karo-la Pass, about 16,000 feet, where Colonel Brander had fought his gallant little action early in May, and the next day debouched on to the most lovely lake I have ever seen—the Yamdok Tso. In shape it was like a rough ring, surrounding what is practically an island; and in colour it varied to every shade of violet and turquoise blue and green. At times it would be the blue of heaven, reflecting the intense Tibetan sky. Then, as some cloud passed over it, or as, marching along, we beheld it at some different angle, it would

flash back rays of the deep greeny blue of a turquoise. Anon it would show out in various shades of richest violet. Often, when overhead all was black with heavy rain-clouds, we would see a streak of brilliant light and colour flashing from the far horizon of the lake; while beyond



The Yamdok Tso or Turquoise Lake, from the Camp at Tamalang.

it and beyond the bordering mountains, each receding range of which was of one more beautiful shade of purple than the last, rose once more the mighty axial range of the Himalayas, at that great distance not harsh in their whitey coldness, but softly tinted with a delicate blue, and shading away into the exquisite azure of the sky. What caused the

marvellous colouring of this lake, which even the Tibetans call the turquoise lake, we could none of us say. Perhaps it was its depth, perhaps it was its saline character, or some chemical component of its water. But whatever the main cause, one cause at least must have been the intensity of clearness in the liquid Tibetan sky, so deep and so translucent that even the sky of Greece and Italy would look pale and thick beside it.

For three days we marched along the shores of this beautiful lake, and then we ascended our last pass and looked down on to the Brahmaputra river, and almost upon Lhasa itself. But the sacred city was still left hid. Masses of mountains in range after range were all we could see in that direction, and General Macdonald had still the very serious obstacle of the Brahmaputra river, now in almost its full flood, to overcome before we could reach our goal. The Brahmaputra we found to be divided into numerous channels, but we were able to cross it at a spot where it narrowed to 200 yards, though not without the loss by drowning of the one officer to whom, of all others in the force, our success in reaching Lhasa was due—Major G. H. Bretherton, the chief supply and transport officer. The river rushed in whirling vortices past a cliff, from which Captain Sheppard, R.E., suspended a wire rope to the opposite side, and upon it rigged up a flying ferry. The river valley was from three to five miles wide, and, like the Gyantse valley, richly cultivated with wheat and barley, dotted over with hamlets, monasteries, well-built and comfortable residences of the great men of the country, and with pleasant groves of poplar, walnut, and even a few peach and apricot trees. The side valleys were also well cultivated, and the hillsides, though bare of trees, were covered with grass, which should afford excellent pasturage for many more sheep and goats than we actually saw there. It was altogether a smiling prospect, and doubts as to the possibility of being able to supply our troops with the necessaries of life, for the year round if required, were at once removed.

I was now met by a variety of deputations, each one of increasing weight and importance, and each more urgent than the last in begging me not to proceed to Lhasa. The Dalai Lama himself even wrote to me—an act of unprecedented condescension on his part; and he sent his High Chamberlain to say that if we went to Lhasa, his religion would be spoilt and he would die. I had to inform him, in reply, of the delicate and painful position in which I was placed, for if, on the one hand, I went on to Lhasa, I understood that His Holiness would die, while if I stayed where I was I would myself die, as I would undoubtedly have my head cut off if I failed to obey the orders I had received and negotiate the treaty in Lhasa itself. Reluctant as I was to cause the premature demise of the Dalai Lama, I felt I had no alternative, I informed the High Chamberlain, but to proceed to Lhasa.

Expectation was now at its height. Each corner we turned we felt sure we should see Lhasa. We hastened to the top of one rise after another in the hopes of catching the first glimpse. The advance patrols

of mounted infantry, on their return, were eagerly questioned. At length, on August 2, we rounded our last corner and saw the golden roofs of the Potala of Lhasa glittering in the distance, and on the following day encamped beneath its walls.

The Potala Lhasa.

Here in a lovely valley covered with trees, rich with cultivation, and watered by a river as broad as the Thames at Westminster, here hidden away by range after range of snowy mountains, lay the mysterious Forbidden City, which no living European had seen before. To many who had supposed, because it was so secluded, it must be a kind of

dreamland city, it was, I dare say, disappointing, for it was after all built by men, and not by fairies. Its streets were not paved with gold, nor were its doors of pearls. The streets were, indeed, horribly muddy, and the inhabitants less like fairies than any I have so far seen.

But the Potala, the palace of the Grand Lama, was an imposing, massive structure, very solidly built of masonry, and picturesquely perched on a rocky eminence dominating the whole plain and the city at its base. Numbers of the houses in the city were, too, well built and solid, and often surrounded by shady trees. The rock-perched palace and the strange city at its base would be striking anywhere, but set in this beautiful valley, deep in the very heart of the mountains, they gathered an additional impressiveness which all who saw them recognised.

It was, however, more to the inhabitants than to their buildings that I had to devote my chief attention during my stay in Lhasa. All the leading men, both lay and ecclesiastical, here came before me, and with them I reasoned and argued and chaffered day after day and week after week. Appallingly ignorant and inconceivably unbusinesslike they were. No one man had supreme authority or full responsibility to negotiate with me. A council were supposed to be the chief executive authorities, but they could do nothing without the consent of the National Assembly, and they, without any presiding officer to control them, or any sense of responsibility, simply censured instead of endorsing what the Executive Council did, while these latter were prohibited from attending meetings of the National Assembly to argue their case in person. A more hopelessly inept organisation for dealing with a crisis in their foreign affairs it would be difficult to imagine. But ignorant, bigoted, and apparently immovable as they were, they had their good points. They were almost invariably polite, and they were genial. The humblest little joke was enough to set them off laughing, and I do not recall separating at the close of a single interview of all the many we had at Lhasa with any feeling of ill temper. I must confess to a feeling of exasperation sometimes when I reflected that my convention had to be got through in so short a time, and no ray of daylight was for so long visible through the dreary clouds of obstruction; but these poor Tibetans do deserve credit for never having really irritated me. It was, after all, their business to make as good a bargain as they could with me, and pertinacity is a trait which need not be cavilled at. Still, it was heavy, weary work. Eight or ten of them would come together. Each one had to have his say, so that when he returned home he could boast that he had for his part spoken up to the British Commissioner. Each one I listened to patiently, and each one I answered. In this way, as every day produced a few fresh men, I worked through most of the leading men in Lhasa, while Captain O'Connor, whose trials were still greater than mine, tackled even larger numbers in his private room.

On the whole, I formed a low estimate of their mental calibre. It is impossible to regard them as much else than children. My talks with them were not only about the business in hand, but about general affairs

and about religion. The Ti Rimpochi, with whom the Dalai Lama left his seal in his flight for Lhasa a few days before our arrival, held the chair of divinity in the Gaden monastery, and was universally rever-

The Tsangpo (Brahmaputra) at Chaksam Ferry. (Note the Iron Chains of the Old Suspension Bridge.)

enced as the leading Lama in Lhasa. He was recognised as regent, and was the principal in the negotiations with me. But even he, pleasant, benevolent, genial old gentleman as he was, had really very little intellectual power, and but a small modicum of spirituality. In both he was very distinctly inferior to the ordinary Brahmin in India. He

liked his little jokes, and we were always on the best of terms. But he was firmly convinced the earth was triangular. His intellectual attainments did not amount to much more than a knowledge by rote of prodigious quantities of verses from the sacred books. Discussion with him upon the why or the wherefore of things ended in bald quotations from the scriptures, and his religion chiefly consisted in ceremonial. The general run of abbots of monasteries and leading Lamas had even less to recommend them. One monastery at Lhasa contained no less than 10,000 monks, and another had 7000. But I do not think any one saw these monks without remarking what a degraded, nasty, sensual-looking lot they were. It is altogether a mistake to suppose that in Tibet is to be found a pure and lofty form of Buddhism. Buddhism and Chinese civilisation certainly have raised the rough tribes who, six or seven centuries ago, inhabited Tibet, into something very much higher than they were before these appeared. But intellectual and spiritual life is stifled by the rigorous monastic rule. All foreign ideas and individual originality have so far been trampled down. And the result is a people of inflexible rigidity, wholly unable to adapt themselves to altering conditions, and without any intellectual force or spiritual impetus. We sought for, but did not find, the wonderful Mahatmas, who would lead us to more lofty peaks of light and wisdom than ever we had trod before. And while I would not deny that Buddhism has done much to tame and civilise a barbarous race of demon-worshippers in Tibet, I would warn those who would look to Lhasa for any kind of higher intellectual or spiritual guidance, to seek nearer home for what they need. Imbued, as the Tibetans are, with much of that impassive contentment inculcated by Buddha, they are still, to all intents and purposes, demon-worshippers. Their religion is grotesque, and is the most degraded, not the purest, form of Buddhism in existence.

Happily we were able to entirely overcome that feeling of obstruction which the heads of the Tibetan Church had so far shown to outsiders. Through Mr. Wilton's influence with the Chinese officials, and Mr. White's connection of many years' standing with the Tibetan lamas in Sikkim, and his tactful suasion, we were able to gain access to all the monasteries and temples, and, before we left Lhasa, British officers went in and out with as little concern as they would to St. Paul's. I insisted upon having the Convention signed in the Potala, and in the finest hall in it, and once the lamas saw no harm resulted, and we invariably treated them with consideration, they entirely withdrew their obstruction, and when, just before leaving Lhasa, I paid a formal visit to the great cathedral called Jo Khang, I was surprised to find them actually pressing me to come inside the railings and walk round the magnificent image of Buddha—a freedom I have never had accorded me in any temple in India.

I fear I have not sufficient time to adequately describe these monasteries and temples. Outside they were solid and massive, though hardly beautiful. Inside they were weird and quaint, and sometimes grotesque. I carried away with me an impression of immense impassive

figures of Buddha for ever gazing calmly and tranquilly downwards, of walls painted with grotesque demons and dragons, of highly decorated wooden columns and roofs, of general dirt and griminess, and of in-

The Ling Kor or Via Sacra at Lhasa.

numerable bowls of butter burning night and day, as candles are burnt in Roman Catholic churches before figures of the saints.

Sooner than I could ever have expected, the Convention was signed, and we prepared for our return to India. Once business had been arranged, the Tibetans were all as happy as possible. No single person was responsible ; each had had his say, and if blame had to fall on any

one, it had to fall on all, and all equally. But in their heart of hearts they knew full well that they had got off remarkably cheaply, and they had indeed the grace to acknowledge this. On the morning of our departure the regent came down to our camp and presented images of Buddha to Mr. White and myself, as well as to General Macdonald. He thanked us for saving the monasteries and temples, and in presenting the image of Buddha to me, said, "When Buddhists look on this they put aside thoughts of strife, and think only of peace, and I hope that you, when you look at it, will think kindly of Tibet."

And certainly I left Lhasa with every kindly thought. It was a perfect autumn day; the sun was bright and warm. The valley was looking its prettiest in its autumn foliage. The entire council, with their secretaries, had come a mile down the road to offer us a farewell cup of tea and to wish us God-speed on our journey. Their last words were that they intended to keep the treaty and be friends with us in future. Our hopeless task seemed indeed to have been accomplished and good will to have been established.

And all that has happened since corroborates this impression. The council had willingly given permission for a party of officers to proceed through Shigatse up the Brahmaputra, to Gartok in Western Tibet, and then back to India by Simla. This important expedition was placed in charge of Captain Rawling, who two years ago had made a most successful journey in Western Tibet, while Captain Ryder, R.E., was in charge of the survey. These two officers, with Captain Wood, R.E., and Lieutenant F. M. Bailey as their assistants, have accomplished their arduous undertaking. Though accompanied by only an orderly each, and no armed escort, they have travelled through a thousand miles of Tibet, and been well received everywhere. Captain Ryder has surveyed 40,000 square miles of country, including the whole course of the Brahmaputra from Shigatse to its source, the Mansorawar and adjoining lakes, and the sources of the Indus and the Sutlej, and has proved beyond doubt that no higher mountain than Mount Everest lies at the back of the Himalayas. The party suffered indeed terribly from the cold, their thermometer registering 24° below zero, but they crossed a pass 18,400 feet in height in December, and reached India in safety.

I trust, therefore, you will believe that the Tibet Mission has not been barren in geographical results, and that when you wish exploration work to be done, there are good and trusty men in India ever ready and willing to do it.

Note.—The illustrations accompanying this paper are from photographs taken by Lieutenant F. M. Bailey, 32nd Sikh Pioneers.—Ed. *S.G.M.*

THE EXPEDITION TO LHASA.

By Ralph Richardson, Hon. Sec. R.S.G.S.

The Society has been fortunate in recently hearing two distinguished men who penetrated the Himalayan range. Mr. Douglas Freshfield brought us to the gate of Tibet by vividly depicting Kanchenjunga and the Himalayas of Sikkim; while Colonel Sir Francis Younghusband took us all the way across the Himalayas on through Tibet to Lhasa, and described in a graphic manner the scenery observed and the difficulties surmounted by the gallant Anglo-Indian force which unveiled the long-hidden capital of Tibet.

It is not surprising that so remarkable a feat should be followed by the publication of a number of works on the subject. Three have been already sent to us for review,[1] and we may remark that all are well worthy of perusal. They appeal at once to our sense of the grand and picturesque in scenery, to our love of obtaining a glimpse of the hitherto Unknown, to our interest in the strange people who inhabit Tibet, and to our admiration of the undaunted courage and invincible energy which impelled our soldiers on their long and arduous march.

Nor should we forget that it was owing to the persuasive diplomacy of Sir Francis Younghusband that the British Mission to Tibet proved so successful. He not merely secured fair and honourable terms of peace, but so won the hearts of the hitherto obdurate rulers of Lhasa, that they, of their own accord, laid bare before him hidden mysteries which had been most jealously guarded for centuries.

Mr. Landon's important work is prefaced by an "Introductory Note" from Sir Francis Younghusband himself, in which, after informing us that, "owing to the magnificent behaviour of the troops, the confidence of the Tibetan people was entirely gained," and that peasants, traders, and monks vied with each other in showing goodwill towards their kindly intruders, he remarks: "How all this was effected none can tell better than Mr. Landon. He took the keenest interest in the mysteries of Tibet, and appreciated to the full the wonderful scenery which, to my mind, was infinitely the most fascinating of all our experiences."

In introducing his subject, Mr. Landon reminds us that complete ignorance of Tibetan geography existed until the survey of Tibet was made by the Jesuits in the beginning of the eighteenth century. He inserts what he considers to be an absolutely erroneous map of 1680, followed by one showing the Tibetan part of the famous survey of China made under the auspices of the Jesuit colony in Pekin, the result probably of the visit of the Jesuit spies to Lhasa, where they resided for thirteen years from 1716, until recalled by the Pope.

---

[1] *Lhasa.* By Perceval Landon, Special Correspondent of the *Times.* 2 vols. London: Hurst and Blackett, Ltd., 1905. Pp. 414 and 426. *Price* 42*s. net.*

The Unveiling of Lhasa. By Edmund Candler. London: Edward Arnold, 1905. Pp. 304. *Price* 15*s. net.*

To Lhassa at Last. By Powell Millington. London: Smith, Elder and Co., 1905. Pp. 200. *Price* 3*s.* 6*d. net.*

In 1774 a Scotsman named George Bogle, a young writer of the East India Company, was sent by Warren Hastings to Tibet to promote commercial intercourse between the two countries; and Bogle's diary and official report contain, in Mr. Landon's opinion, "by far the most judicious" account of the life and customs of Tibet that has yet been written. In 1783 Samuel Turner was accredited by Hastings on a similar mission, and Mr. Landon gives his map of the Phari Gyantse road, which he declares is better than the best London maps of 1903.

In recent years, under the influence of Dorjieff, the Russian Agent in Lhasa, a considerable body of opinion inimical to Britain was formed, and the Tibetans encroached on our territory in Sikkim, broke their commercial treaty with India, and returned unopened letters sent by the Viceroy to the Grand Lama in Lhasa. In 1903, therefore, Lord Curzon despatched Colonel Younghusband to Kamba jong to negotiate with the Tibetans, and he was accompanied by Captain O'Connor, "the only white man who can speak Tibetan fluently."

Negotiations at Kamba jong failing, a British force under General Macdonald, with Colonel Younghusband as Commissioner, proceeded towards the Chumbi valley, and on 13th December 1903 reached Yatung, and made its way through the gateway of the Tibetan wall. "Before the coming of this Mission, no white man had ever known the Chumbi valley," of whose inhabitants Mr. Landon gives a graphic description, adding: "Nowhere in the world will you find such exquisite teeth in men, women, and children alike as in Tibet."

On 11th April 1904 the Mission reached Gyantse, the first view of which is imposing, with its Gibraltar-like high-walled hill, from which the town derives its name (signifying "royal peak"), and which rises 500 feet above the level plain. Splendid illustrations of this interesting fortalice are given. The author and Captain O'Connor rode out about twelve miles to the dwellings of the Buried Monks, who immure themselves in dark cells in the rocks, first for a period of six months, then for one of three years and ninety-three days, and during the third period for life. "Only this morning," said the Abbot, "a hermit died here after having lived in darkness for twenty-five years."

The hitherto peaceful character of the campaign was broken in May by the Tibetans attacking the Mission post at Gyantse. Mr. Landon gives a spirited account of the Karo la fight, in which Captain Bethune was killed, and in which a dozen men under a native officer, Wassawa Singh, scaled the almost perpendicular face of the 1500 feet southern scarp, a climb which few members of the Alpine Club would have attempted, and for which Wassawa Singh received the Order of Merit. This fight occurred at the height of 18,000 feet, probably the highest point at which an engagement ever took place. After a long and daily bombardment of the post at Gyantse, a relief force arrived, and on 5th July the Gyantse jong was gallantly captured by a Gurkha storming-party, led by Lieutenant Grant, who afterwards received the Victoria Cross.

The march on Lhasa began on 14th July in pouring rain; but the sun lit up the famous Yamdok Tso, or "Turquoise Lake" (see illustration, p. 238),

the most interesting inland sea of Asia, in the opinion of Mr. Landon, who thus describes it: "There are few sights in the world like that which is seen from the peak in which the saddle of the Ta la ends to the east. Below lie both the outer and the inner lakes, this following with counter-indentations the in-and-out windings of the other's shoreline. The mass and colour of the purple distance is Scotland at her best—Scotland, too, in the slow drift of a slant-woofed raincloud in among the hills. At one's feet the water is like that of the Lake of Geneva. But the tattered outline of the beach, with its projecting lines of needle-rocks, its wide, white, curving sand-pits, its jagged islets, its precipitous spurs, and above all, the mysterious tarns strung one beyond another into the heart of the hills—all these are the Yam-dok's own, and not another's. If you are lucky, you may see the snowy slopes of To-nang gartered by the waters, and always on the horizon are the everlasting icefields of the Himalayas, bitterly ringing with argent the sun and colour of the still blue lake. You will not ask for the added glories of a Tibetan sunset; the grey spin and scatter of a rain-threaded afterglow, or the tangled sweep of a thundercloud's edge against the blue, will give you all you wish, and you will have seen the strangest view in all this strange land. Here and there along the shore to north and south rise half-ruined castles, as harmonious, as inevitable, as everything else in this high enchanted valley."

Then came the Tsangpo or Brahmaputra River, crossed fortunately by the British in the ferry-boats the Tibetans had forgotten to destroy; and then the approach to Lhasa. "There was a smell of fresh spring earth, and the little rustle of a faint wind in the heads of the barley; the sun was merciless in a whitened sky, wherein from horizon to horizon there was never a flash of blue. . . . Then, as we rode on, it came. In the far, far distance, across and beyond those flat fields of barley, marked here and there by the darker line of low-wooded plantations, a grey pyramid painfully disengaged itself from behind the outer point of the grey concealing spur—Lhasa."

No artist will ever paint a better picture of Lhasa than the word-picture given by Mr. Landon:—"Between and over the glades and woodlands, the city of Lhasa itself peeps, an adobe stretch of narrow streets and flat-topped houses, crowned here and there with a blaze of golden roofs or gilded cupolas; but there is no time to look at this; a man can have no eye for anything but the huge upstanding mass of the Potala palace to his left; it drags the eye of the mind like a lodestone, for indeed sheer bulk and magnificent audacity could do no more in architecture than they have done in this huge palace-temple of the Grand Lama. Simplicity has wrought a marvel in stone, 900 feet in length and towering 70 feet higher than the golden cross of St. Paul's Cathedral. The Potala would dominate London—Lhasa it simply eclipses. By European standards it is impossible to judge this building; there is nothing there to which comparison can be made. Perhaps in the austerity of its huge curtains of blank, unveiled, unornamented wall, and in the flat unabashed slants of its tremendous south-eastern face, there is a suggestion of the massive grandeur of Egyptian work; but the

contrast of colour and surroundings, to which no small part of the magnificence of the sight is due, Egypt cannot boast."

From a geographical point of view, both Mr. Landon's and Mr. Candler's works are very satisfactory in having excellent maps showing the route of the Expedition, with the date of its arrival at each place. Mr. Landon's map (by Messrs. Bartholomew) also shows the contour of the country traversed. The greater part of Mr. Candler's book was written on the spot, and is illustrated from fine photographs by Lieutenant Bailey and others. Owing to wounds, Mr. Candler was not present at the bombardment and relief of Gyantse, but this phase of the operations is described by Mr. Henry Newman, Reuter's correspondent, who was an eye-witness.

Mr. Powell Millington also accompanied the Expedition, but modestly claims that his book is only by "a man in the street—a man, that is, who occupied an inconspicuous single-fly tent in a back street of the brigade camp." The result is one of those light, humorous, entertaining narratives with which the average Englishman often enlivens and minimises serious work successfully performed.

NOTES ON A JOURNEY IN BOLIVIA AND PERU AROUND LAKE TITICACA.[1]

By Arthur W. Hill, M.A.,
Fellow of King's College, Cambridge, and University Lecturer, Bombay.

The Continent of South America, as a reference to a map will show, is longitudinally divided into an eastern and western portion of very unequal dimensions by the chain of the Andes, which stretch in an unbroken line from the Isthmus of Panama to the Straits of Magellan.

This vast rocky chain, whose lowest passes, except in the extreme south of Chile, exceed 12,000 feet in altitude, exerts a marked influence on the climatic conditions of the eastern and western portions of the Continent. On the eastern side, except in South Patagonia, the country is well watered and covered for the most part with luxuriant forest, and is traversed by the rivers Orinoco, Amazon, Paraguay, and others. On the western side a long rainless tract extends from Southern Chile in about lat. 33° S. (near Valparaiso) to the boundary between Peru and Ecuador, about 4° south of the Equator. The Andes rise quickly from the coast, but the actual coastline is formed by a range of foothills of varying height. The rivers are short and very frequently never reach the sea, since they either dry up or are used for irrigation, for owing to the great scarcity of rain it is only possible to grow corn or fodder for animals by means of an elaborate system of irrigation canals.

[1] An Address delivered before the Society on January 4th.

The desert coastline is occupied by the republics of Chile and Peru, the former stretching from Tierra del Fuego to about lat. 18° S., and lying almost entirely on the western slopes of the Andes; whilst Peru stretches from 18° S. to the borders of Ecuador, and not only occupies the strip of the coast on the western side, but extends over a vast amount of territory in the high plateau region of the Andes, and into the head-waters of the Amazon on the eastern side of these mountains.

The Republic of Bolivia, in which I was travelling in the spring of the year 1903, is now a wholly inland country, being separated from the sea by Chile and Peru. Like Peru, it comprises the most varied types of country within its bounds. The most thickly populated part lies in the great plateau region of the Andes, between the eastern and western ridges, and thence extending over the eastern crest it embraces the territory drained mainly by the head-waters of the river Mapiri, one of the principal affluents of the Amazon.

The great plateau region of the Andes, which lies partly in Peru but mainly in Bolivia, occurs between lat. 14° S. and 22° S., and has been formed by the division of the crest of the Cordillera (*i.e.* the Andean chain) into an eastern and western portion. The region enclosed between these two ranges, which has an area of some 106,000 square miles, is over 12,000 feet above the sea, and in it lies the great lake of Titicaca, at an altitude of 12,500 feet.

It was around this lake, which is about 160 miles long by some 60 to 80 miles broad—being therefore about fourteen times the size of the Lake of Geneva—that I spent a good deal of my time, studying the flora of the country generally and especially of the mountains on the eastern side. Afterwards I went up to Cuzco, the ancient capital of the Incas, whose descendants in the persons of the Aymará and Quechua Indians form the bulk of the population of the high plateau.

Bolivia, having no seaboard of its own, has to be approached either through Chile or Peru, if one is coming from the west, and the journey may be accomplished once a week, either from Antofagasta in Chile by a long and tedious railway and coach journey to La Paz, the capital of Bolivia, or else one may land at Mollendo in Peru and go by train to Puno on Lake Titicaca, a two days' journey, in the course of which the line rises to a height of 14,666 feet when crossing the western ridge of the Cordillera.

From Puno the journey is continued by steamer—built in the Clyde—to Chililaya or probably by now to Guaqui, the Bolivian port at the south end of the lake, distant some 111 miles from Puno; and from Chililaya to La Paz is a coach drive of some 30 miles over the roughest kind of road imaginable. A railway has been built from near La Paz to Guaqui, and is I believe now in working order, but as the city of La Paz, 11,500 feet above the sea, is situated at the bottom of a steep gorge about 1500 feet below the general level of the plateau in this region, the engineering difficulty of taking the railway down to the city from the "alto" had not been solved in theory when I was in the country, and owing to the state of the Bolivian treasury is, I think, hardly likely to be solved in practice for many years to come.

Sailing from Valparaiso on Christmas Eve, 1902, we reached Mollendo on the 30th of December, calling on our journey at Antofagasta and Iquique, the ports amongst others whence the nitrate of soda or Chile saltpetre is shipped. The coast is here practically rainless and very barren. From Mollendo the first day's journey brings the traveller to Arequipa, 7500 above the sea, a very beautiful city, magnificently situated at the foot of an amphitheatre of snowy mountains.

Shore of Lake Titicaca near Copacabana, showing the remarkable T-shaped promontory with the Island of Titicaca beyond.

After a brief stay to enable one to get accustomed to the rarefied air, which is often found very trying in the Andes, we journeyed to Puno, taking our muleteer or "Arriero" with us, and went on board the steamer, where we slept the night. It is very remarkable to find a fairly large Glasgow-built boat on this lake at such a height above the sea.[1]

Steaming away from Puno early in the morning, we accomplished the journey of 111 miles to Chililaya in fourteen hours; the day was

[1] This boat, the *Coya* (*i.e.* Queen or Empress), was built by Messrs. Denny of Dumbarton; there are two other smaller steamers, and I believe another twin-screw steamer is shortly to be despatched from England for service on the Lake.

magnificent and the scenery one of extreme grandeur. In places the lake is so vast that one appears to be out at sea. During the voyage the Island of Titicaca, sacred to the sun, is passed, from whence Manco Capac and his wife, the children of the sun, set out to organise the government and religion of the savage tribes around. In the course of their wanderings they finally reached Cuzco, where they set up the seat of government and so founded the Inca dynasty, as all readers of Prescott's *Conquest of Peru* will remember. We also passed the Island of Coati, sacred to the moon, containing, like the Island of Titicaca, many ruined temples and palaces of great interest. As we neared the southern end of the lake towards evening, the great mountains of the Bolivian Andes, forming the crests of the eastern ridge of the Cordillera, slowly cleared, and the long unbroken chain of sixty-four miles from Illampu above Sorata to Illimani above La Paz stood out in all their snowy grandeur against the clear sky. The mountains, which are about 22,000 feet high, were a wonderful sight in the brilliant sunlight.

Towards sunset (six o'clock) thunder-clouds gathered in the west, and the effect was magnificent. To the west was an orange sunset, partly obscured by thunder-clouds, which every minute were ablaze with violet flashes of lightning, every variety of forked and sheet, whilst to the south-east the snowy chain of the Andes was just visible in the twilight with the moon rising above them. Suddenly the storm struck us and the lake became like a choppy sea, whilst hurrying clouds blotted out the dying traces of a truly memorable scene.

Such effects as the above were of common occurrence on the plateau, where the air is extremely clear and so charged with electricity, owing no doubt to the intense radiation, that thunder-storms were of nightly occurrence.

After a second night on board we set out for the thirty-mile drive to La Paz in the early morning, in a remarkable coach-like vehicle called a "Tilbury," drawn by six mules. As the so-called roadway ran indiscriminately through fields and rivers or over rocky stretches of country, and as the mules were kept at a gallop with the help of a long whip, or by means of stones or other missiles deftly thrown by the driver at the leading pair, who were out of range of the lash, the journey may perhaps be better imagined than described. The descent by a zigzag road from the top of the plateau to the city of La Paz at a breakneck speed was, to say the least, exhilarating, and I must confess I was somewhat surprised when we finally drew up in safety.

At La Paz we spent a week buying mules, bedding, stores, "Petacas"—the skin boxes carried by the pack mules—saddlery and other necessaries for the journey, and at 2 P.M. on the 20th of January 1903 we set out only a day and a quarter later than we had intended, which, considering the country and the general habits of the Spanish-American, was fairly creditable. The cavalcade consisted of a friend and myself, with Francisco, our arriero, Martino, an Aymara Indian who spoke Spanish, and six mules.

We travelled towards the southern end of Lake Titicaca, across the plateau, which is here arid and desolate. The country around the lake

is in most places cultivated by the Indians, who grow potatoes, barley, broad beans, quinoa—a kind of goosefoot (*Chenopodium quinoa*), ocas—a tuberous form of oxalis, lupins and other plants, with some success if the season is favourable. The rainy season in the plateau region occurs from December until the end of March, and it is only during this period that it is possible to grow crops. During the dry season the soil is

An ancient Stone Figure about 10 feet high at Tiaguanoco.

baked by day and frozen at night, so that only the most resistant types of vegetation are able to survive.

The climatic conditions in this region affect the human traveller as well as the vegetable kingdom, and owing to the dryness of the air it is as well to regard the washing of oneself—an art apparently unknown to the Indian population—as a luxury rather than as a necessity. The frequent oiling of one's face and hands is a necessary preventive against burning and loss of skin.

The climatic conditions also exert a marked influence on the dress of the country, which I may briefly refer to here. Owing to the great differences between the day and the night temperatures and the liability to rapid diurnal fluctuations, clothing is of thick woollen materials. The universal garment of the men is the poncho—an article like a blanket, with a hole cut in the middle for the head to go through—which is an excellent covering and very pleasant to ride in, as it keeps one cool in the hot sun and warm when the air gets cold. Besides this the men always wear a thick scarf round their necks, and on their heads a knitted woollen cap with ear-flaps beneath a felt hat. Under the poncho they wear various under-garments and trousers of a peculiar cut, reaching to the knees; their legs and feet are usually bare, though they often wear sandals when it is dry and clean under foot. The women have voluminous skirts of brightly-coloured materials, and as they never take off an old skirt when they put on a new one, they frequently present a bulky and inartistic appearance. Like the men, they have bare legs and feet.

Cholo women, that is the half-breed Spanish and Indian, are in marked contrast to the pure Indian women, since they wear finely-plaited straw hats, jauntily placed on the side of their heads, and though their brown legs are bare they walk about in patent leather slippers.

The Indian men and women nearly always carry bundles slung on their backs. The men appear to be remarkably strong, and can carry very heavy loads, and the women carry anything from bundles of barley to babies in brightly-coloured shawls, slung over their shoulders.

Near to the southern end of the lake, at the end of our second day's journey from La Paz, we came to some wonderful ruins, remnants of an ancient and forgotten civilisation. They consist of huge upright blocks of stone accurately squared, of archways and stone figures, which in some cases are richly ornamented, and various other curiously cut stones, which it would take many pages to describe in detail (cf. illustration, p. 253). How these stones were quarried and worked with such accuracy is one of the mysteries which still enshroud the land of the Incas.

The modern Spaniard has unfortunately wrought havoc and destruction at Tiaguanaco, for not only have the stones been broken up for the building of churches, but quite recently the larger blocks have been found remarkably useful for railway bridges, and in many places the new line to the lake is carried across a stream or gully on a single monolith. Truly one may say of these ruins, as Shelley says of Ozymandias :—

> "Nothing beside remains. Round the decay
> Of that colossal wreck, boundless and bare
> The lone and level sands stretch far away."

These ruins, extending over several acres of ground, part of which is an enormous artificial mound, must I think have been built on an island in the lake, which in former times was very much larger than it is at present. Owing no doubt to changes in the rainfall, the lake has receded and is still shrinking, and its shores are now some six miles away to the northward.

Travelling onwards from here we came to the river Desaguadero, flowing out from the south-western corner of the lake. Whereas many streams discharge themselves into the lake from the surrounding hills, this river, which is not very large, is its only outlet, and the water is therefore maintained at a general level mainly by the excessive evaporation. In the broad shallow reaches of the river and in the shallow water at the margin of the lake a tall sedge (*Scirpus*) grows in

The shore of Lake Titicaca, near Desaguadero. The hills are composed of Old Red Sandstone, and rise to about 2000 feet above the level of the lake. A patch of Scirpus is seen in the lake.

abundance and attains a height of six to ten feet. It is from this that the native boats or balsas are built. The sedge is tied up into long fusiform bundles of some ten to twenty feet in length; two bundles are then bound firmly together, their ends are turned up to form a definite bow and stern, and a very serviceable boat is thus formed, which will last for about a year. Different forms of balsa are made at different places along the lake shore, but the material is always the same. As there are very few trees on the plateau, wooden boats are not built by the Indians.

The balsas are either sailed or punted along close in to the shore. There is one enormous one, which plies between Titicaca Island and

the mainland, holds thirty people, and is rowed by four Indians. The oars consist of long poles, not necessarily straight, with the sides of kerosene tin boxes nailed on to the ends to serve as blades. As each Indian rows his own time, the motion of the boat is as peculiar as its appearance.

From Desaguadero we went to Copacabana, celebrated for an image of the Virgin, said to have been made by the Inca at the time of the Conquest. We had the good fortune to be there on the 2nd of February —the Feast of the Purification—which is kept as a great Indian festival. The Indians flocked to the village and danced and sang for three days in wonderful garments, and did many strange things, besides getting somewhat intoxicated. It was obvious that some old heathen festival had been utilised by the Spanish missionaries and converted into a Christian rite, for on one evening, amongst other things, forty life-size bulls made of paper and loaded with crackers, supplied by the priests, were set on fire in the Plaza. All the while a deafening noise was being made on horns, pipes, skin drums and other peculiar musical instruments by the hundreds of Indians present, and the heavens above were as usual giving vent to their feelings with the nightly displays of lightning and rumblings of thunder.

We made Copacabana our headquarters for about a week, and paid a visit during this time to the Island of Titicaca, where we visited the remains of the Temple of the Sun and the Palace of the first Inca; both buildings show the sloping sides to the doorways, windows and niches, which are so characteristic a feature of all Inca architecture.

On returning to the mainland we continued our journey in an easterly direction, ferried across the lake with all our personal goods at the narrow Straits of Tiquina, and after crossing the watershed of the eastern range of the Andes, arrived at the town of Sorata.

The change in the character of the country and the abundance of vegetation on the eastern flanks of the Andes is very remarkable, a journey of some six hours taking one from the arid plateau into a region of semi-tropical luxuriance. Whilst here I made an expedition up the mountain Illampu as far as the snowline, here about 16,500 feet, in search of plants. On this, as on other occasions when I ascended to high altitudes, I found many curious plants of considerable interest, nearly all of them being peculiar in showing a very compact habit of growth with minute linear leaves and extremely long tap roots. The highest plants which I found were growing at an elevation of over 17,000 feet on a mountain in Peru.

The flora of the High Andes is of considerable interest owing to its highly specialised character, and also to the affinities which it exhibits to the flora of New Zealand and the Antarctic islands.

There are some seventy-six genera of plants common both to New Zealand and South America, and though some of these occur also in Australia and other parts of the Old World, about seventeen are confined exclusively to the two countries; amongst these latter may be mentioned Calceolaria and Fuchsia.

The genus Azorella (Umbelliferæ) is a very typical Andean plant, and

extends from Tierra del Fuego to Colombia, being also found in Kerguelen's Land and other Antarctic islands as well as in New Zealand.

In the Andes of Bolivia this genus occurs between the altitudes of 12,000 and 15,000 feet, and often forms large mounds as shown in the illustration. The plant is much branched, and the branches with their minute leaves are packed so closely together that a green hard mound is

Azorella *sp.* forming mounds 2 to 3 feet high at about 14,000 ft. on the slopes of El Misti. Drops of resin appear white in the photograph.

formed, which is often as much as three feet in height. As these plants are very resinous, they are largely used for firewood on the plateau, and are known under the general name of "Llareta."

When these resinous Umbelliferæ are unattainable, the firewood or Leña gatherers bring in small resinous bushes of Baccharis (Compositæ), a peculiar Andean shrub. But Llama dung is the more common fuel, especially in La Paz and on the steamers on the lake.

This absence of good fuel is a serious drawback on the plateau; and though coal has been found on the Island of Titicaca, it does not appear to be of sufficiently good quality to pay for the working.

I visited the seams of coal when I was on the island, and as the

strata are almost vertical[1] the course of the narrow bands of coal lying between layers of white sandstone is very easy to follow.

The owner of this part of the island told me that fossil plants had been found in the coal, and I was most eager to obtain some specimens. The Spanish American, however, is unfortunately not easily aroused, and puts off any matter until the morrow with invariable politeness, and as I had not the time to investigate matters myself, I am not able to furnish any trustworthy evidence of the existence or nature of these fossil plants.

Some of the rocks on the island appear to be Carboniferous, and the red sandstones of the mainland close by, forming the western ridge of the Cordillera, are undoubtedly of Devonian age.

The town of Sorata is situated on the head-waters of one of the branches of the Rio Beni (Amazon), at an elevation of about 10,000 feet above the sea, and is one of the centres of the rubber trade of the Upper Amazon. Large quantities of rubber are brought here on pack mules from the forests lower down the river, and are then carried in the same way over the pass of the Eastern Andes to Lake Titicaca, shipped across to Puno, and thence are taken by rail to Mollendo on the Pacific coast.

The pads of rubber which are thus shipped to Europe or North America are usually impure, and the crude material has to undergo processes of refinement before it can be put to commercial uses. This is largely owing to its method of collection in the Amazonian forests. V-shaped incisions are made into the bark of the rubber-trees by the Indian collectors, and the thick milky juice which exudes runs down into vessels placed on the tree. When the vessels are full they are taken to the huts and the juice is smoked. The method of procedure is as follows. Long flat pieces of wood are dipped into the fresh viscous fluid and are then held in the smoke of specially constructed fires, which causes the rubber particles to coagulate and a layer of rubber to be formed round the end of the stick; this is again dipped into the vessel, and the process is repeated until a pad-like mass of rubber, weighing some pounds, has been collected on the stick. The pads of rubber are nearly always cut open by the overseers to see that no stones or other heavy articles have been introduced into the mass by the Indian collectors, who are paid by the weight of rubber they bring into the stations.

From Sorata we returned over the pass to the plateau and continued our journey along the eastern shore of the lake, making frequent botanical digressions into the hills alongside our route.

We usually slept at the houses of the "Corregidors," or head men, of the little villages which we passed through, a room built—like all the houses—of sun-dried mud (adobe) and thatched with grass being assigned to us. If the roof was water-tight I spent a comfortable night, after having cooked and eaten dinner and seen to the pressing and

[1] Cf. the strata in the view near Desaguadero. The steep slope of the T-shaped promontory and the similar slope in the distant island represents the angle of inclination of the beds.

changing of the paper of my plants, and finally to the writing of my diary. Frequently, however, the roof let in the water, and we had to sleep under mackintoshes, or the mules got out of the "corral"—the yard where they had been shut in—or else Francisco snored to such an extent that repose was interrupted and fitful. At a village on the northern shore of the lake the Corregidor's room, with a dead sheep hanging up in it, dogs and hens on the floor, and a very dirty Indian woman seated spinning, looked so unpleasant that I suggested we should go to the priest. This we eventually did, and were very kindly entertained. Our host was a remarkably inquisitive man, and expressed a great desire to have my mackintosh sheet and the corks of my bottles, but above all things he begged me to send him my portmanteau, to which he had taken a great fancy. He was very anxious to see us undress and go to bed, but after some trouble we managed to get rid of him.

We left the next afternoon, after dining with him at three o'clock; as he had seen our soup packet, he asked me to make some soup for dinner, but was apparently disappointed with my cookery. After some of his own soup to follow, and some fish, we left for Huancane, about two leagues off, with the Curé's parting request for my portmanteau ringing in my ears.

On arriving at six o'clock we found the town *en fête*, as the new Sub-Prefect had just arrived, and was about to be entertained at dinner by the Gobernador. We were at once invited in, and had to do justice to quite an enormous meal, comprising many dishes peculiar to the country. Among these was a piquante, hot and orange coloured, owing to the red pepper it contained. A real Indian piquante is practically inedible to the untrained European.

From here we travelled to Juliaca on the Puno-Arequipa railway line, after crossing two of the largest rivers which run into the Lake from the North. The ferry boats in use on these rivers are the usual sedge balsas, but they differ somewhat in build from those used on the Lake.

The Indian huts in this region are conical, shaped like beehives, and built entirely of adobe bricks, a small doorway at the base, and perhaps a small opening at the top being the only means of ventilation. The villages composed of these conical huts had a very curious appearance.

On reaching Juliaca I had come to the end of the longest part of my journey, and from here my friend had to return to Arequipa. As I still had some time at my disposal I travelled on to Cuzco, the ancient capital of Peru and centre of Inca civilisation, and spent some time in the city itself, and also among the mountains beyond, where I was able to add considerably to my collections.

Space, however, will not allow me to describe my wanderings in any further detail, and I feel that the conclusion of the journey around the lake forms the most fitting termination of this short and sketchy narrative.

THE PROPOSED ANGLO-ABYSSINIAN BOUNDARY IN EAST AFRICA.

By S. H. F. Capenny.

(*With Map.*)

It has been generally assumed since 1891 that the limits of the British sphere to the northward in East Africa had been settled. According to the Anglo-Italian Protocol of March 24, 1891, the boundary, as then determined, was to follow the median line of the Juba from the sea up to the 6th parallel of north latitude, and then along that parallel to the 35th meridian of east longitude. As the basin of the Upper Juba was at that time for the most part an unknown country, it was provided in the Protocol that, should future explorations show occasion, the line of demarcation along the 6th parallel should be amended in its details in accordance with the hydrographic and orographic conditions of the country. Between 1893 and 1896, with the explorations of Mr. Donaldson Smith and Captain Bottego, our knowledge became positive and precise, and it was seen that the Protocol of 1891 provided a feasible scheme of delimitation. In the framing of that Protocol, Italy had assumed the right to act on behalf of Abyssinia, according to her own interpretation of the Uchali Treaty with the Emperor Menilek, May 2, 1889. But Menilek, who had already disregarded this interpretation by dealing directly with foreign Powers in 1890, denounced the treaty in February 1893, and finally assumed full control of his foreign relations by the Adis Ababa Convention with Italy, October 26, 1896. In the spring of 1897 direct relations were established between Great Britain and Abyssinia. As the terms of this Anglo-Italian Protocol have been adhered to in England, it has been generally hoped that they would likewise be observed by the Abyssinians. It would seem that in 1900 negotiations had been opened at Adis Ababa, that a provisional agreement for a frontier had been arrived at, that difficulties had arisen about its precise direction, and that these difficulties had been complicated by an Abyssinian occupation of parts within the British sphere.

It was with a view to furnishing a detailed map which would render it possible to fix by geographical features the frontier already agreed upon in principle, that Mr. A. E. Butter conducted an expedition in order to survey as broad a strip of country as possible in the zone through which the proposed frontier was designed to run. The expedition left Adis Ababa on the 6th November 1902. It consisted of Mr. A. E. Butter, Mr. J. L. Baird (of the British Agency, Adis Ababa), Captain P. Maud, R.E., with Mr. Wakeman, the assistant-surgeon of the British Agency, in medical charge; and it was accompanied by Count Colli, of the Italian Legation. Captain Maud was assisted in the survey work by two natives of India. The Abyssinian representatives were Atto Mamma, who had spent several years in France, and two Kanyazmaches, who represented the Dajazmach of Sidamo and the Fitaurari of the Boran country. Captain Duff joined the expedition with a relief caravan from Adis Ababa, in March, at Dire in Tertale, east of Lake Stefanie.

The initial objective of the expedition was a bend in the Ganale river shown on Bottego's map, from which the line of the latest frontier proposals of 1900 commenced. The point of assembly for the expedition was at Mount Zuquala, thirty-five miles south of Adis Ababa. Starting froms that point on the 11th of November, they followed the western shore of Lake Zwai, passed between the salt lakes Langano and Horadako, and then entered the rich undulating uplands of Sidamo. About twenty-five miles east of the north end of Lake Abaya they struck south-east and crossed the range of mountains which runs roughly NNE. and SSW., and form the watershed between the drainage north-west into the chain of lakes from Zwai to Abaya and south-east to the Ganale and Daua rivers. This range was crossed near Gurbicho at an altitude of 8000 to 9000 feet, and as the camels suffered severely Mr. Butter quickly led the caravan down to the lower altitude of Liban. Captain Maud had been surveying along the whole route, and he followed more slowly, and after passing through the high country of Jamjam, a province of Sidamo, he caught up the caravan on the 21st of December at Darar, on the Sidamo-Liban frontier.

From Adis Ababa Captain Maud had carried down longitude to a prominent hill, Gara Berbissa Tuto, in southern Jamjam, by a line of latitude and azimuth, and near it he first saw the Ganale river. There he surveyed a bend of it, but found out later that the bend of which he was in quest was some fifty miles further down stream. South of "the bend" lies Dida Liban, a large, slightly undulating, yellow grass plain, with scanty thorn bush; it extends south as far as the Daua, and it is said to occupy the whole of the space between the Ganale and Daua rivers down to their junction north of Lugh. The western boundary of Dida Liban is formed by a fir (Ted) covered ridge which runs from near "the bend" almost due south to the Daua river. North-west of this ridge, at Goba, they came upon the first inhabitants of Liban, who are Gona Borans, and there the chief resides. The Daua is formed by the union of two head-streams, the Awata and the Aflata; at their junction is Hiddi Birra, where Captain Maud joined Mr. Butter and the main caravan on the 17th of January 1903. About thirty miles to the south-west is the Abyssinian part of Arero, from which the Abyssinians control the whole of the Boran country. From Hiddi Birra the main caravan was sent to Muggado (called Mogado by Mr. Baird, better known as El Magad), which point would be passed in proceeding to Lake Rudolf.

When the country between the Ganale and the Daua was surveyed along the line proposed in 1900, it was found to present no physical feature to assist in defining a frontier. It was therefore considered quite unsuited for that purpose. Any line drawn through it would (1) follow no natural features, (2) divide land grazed over by the Borans, and (3) necessitate the expenditure of a considerable sum for marking and garrisoning; it would have to be an entirely artificial line, and unless held by force would not be respected; the country gained would be valueless; the land lying between such a line and the Ganale is waterless in the dry season, when it is uninhabited except by a few goat-herds; during the rains it is occupied by the Borans, who live nearer

ABYSSINIAN FRONTIER QUESTION.

1891 Boundary — — — Proposed Boundary along Goro Escarpment . . . . .
Other Boundaries — . — . —

Copyright

Bartholomew, Edr.

the Daua during the dry season; it would be justified only by striking natural features and tribal differences, both of which were absent.

It would seem that the problem with which the Mission had now to deal was to ascertain the limits of the Boran territory. In the negotiations of 1900 Menilek had been willing to agree to a partition of Borana, but it was now discovered that the tribal organisation would hardly admit of division. Whatever may be said about the frontier suggested by the Mission, there can be no doubt regarding the good work achieved in the accurate survey and the topographic and ethnographic knowledge of Borana. The Boran territory consists of Liban, Dirri, and Tertale. Liban is the district between the Ganale and the Daua; Dirri extends from the Daua to the Goro escarpment, and consists of large, flat, and undulating plains, with many hilly districts; Tertale is the high land NE. of Lake Stefanie. The true Boran countries are Liban and Dirri. South of the Goro scarp, and some 1500 feet below it, is the lowland district of Golbo.

The chief Abyssinian representative soon made known what was the view held by Menilek. He averred that he had been instructed to proceed to the junction of the Ganale and the Daua above Lugh, then to turn his back on the Ganale and proceed westward to Lake Rudolf, keeping the Boran territory on his right. The British representatives adhered at first to the line of the provisional agreement of 1900, but finally, as it would seem in their desire for a frontier well marked physically, they came to adopt the Goro scarp.

In his recent work on the *East Africa Protectorate* Sir Charles Eliot discusses the southern advance of the Abyssinians, and comments on it as a serious matter, although the region is remote and people hardly think more of it in Mombasa than they do in London. He alludes to the visit of inspection paid to the frontier by the expedition under Mr. Butter, and hopes that an amicable arrangement will soon be concluded by which the Abyssinians will be kept as far to the north as possible. "We cannot," he says, "any longer expect to keep them above 6° N., but possibly a line between 3° and 3·50°, following the natural features of the country, would be acceptable to both parties. There is said to be an escarpment running through this part, with an uninhabited, unhealthy strip at the bottom. This would make a good frontier, for if the escarpment were left to the Abyssinians they would have little temptation to advance beyond it. Unless it is thought essential to have a strip affording right of passage round the head of Lake Rudolf, it would appear to be immaterial where the frontier cuts the eastern shore, as the whole of this district is reported to be desolate and devoid of vegetation."

It would not be fitting to discuss here the political aspects of this frontier problem. But it is to be hoped that the Government will strongly uphold the principle of delimitation which was recognised in 1891. The Borans have been from the first regarded as coming within the ambit of the East Africa Protectorate; they have themselves desired British protection; and the recent history of Somaliland will occur as a warning to all who are concerned about this inland part of East Africa and the future of that fine race, the Galla or Oromo.

PIGMIES IN THE HEBRIDES: A CURIOUS LEGEND.

By W. C. Mackenzie, F.S.A. (Scot.), Author of *The History of the Outer Hebrides.*

There are "travellers' tales" in abundance about a mysterious islet off the coast of Lewis (the largest island of the Outer Hebrides), which went by the name of the "Isle of Pigmies." The first to mention it was Dean Monro, who visited Lewis about 1549. The Dean describes a small chapel on the isle, beneath the floor of which "many men of different countries" had delved for the bones of a race of pigmies who, according to tradition, were buried there. He himself followed their example, and discovered a number of the bones of the alleged pigmies. George Buchanan, in his *History of Scotland*, quotes the Dean, whose story about the pigmies he found perfectly credible. Several other travellers have left more or less circumstantial accounts of the isle and its chapel, the most illuminating being that of an Englishman named Captain Dymes, who visited Lewis in 1630. Dymes, however, was apparently proof against the popular idea, for, after digging up some of the bones, he avows, in his quaint phraseology, that "my belief is scarce big enough to think them to be human bones." But the poet Collins was less critical, for in his *Ode on the Popular Superstitions of the Highlands of Scotland*, published in 1749, he describes in eloquent terms the little chapel with its pigmy remains.[1]

Early in the nineteenth century, a critic arose in the person of Dr. John M'Culloch, who in his letters to Sir Walter Scott denied point-blank the very existence of the Isle of Pigmies, and sneered at Dean Monro's veracity for seeking to impose such a fiction upon his readers. And M'Culloch's statement was accepted as the last word upon the subject, until the other day, when I had the good fortune to re-discover the celebrated isle, with its chapel.

Subsequently, an exhaustive examination of the isle and its remains was made by my brother, Mr. C. G. Mackenzie, and my cousin, Dr. Mackenzie, both of Stornoway, and the latter prepared a most interesting report giving a fully detailed account of their discoveries. The "chapel" proved to be one of the chambers of a subterranean construction, connected by a passage with a larger and circular chamber; the smaller one, which is oblong in shape, being the only portion of the entire structure known to previous investigators. A piece of pottery was found, the line pattern on which is of the crude nature usually associated with the art of the late Stone or early Bronze period. A good many bones were unearthed, which I submitted for expert opinion; and Dr. Charles W. Andrews, of the Natural History Museum, South

---

[1] "To that hoar pile which still its ruin shows,
In whose small vaults a pigmy folk is found,
Whose bones the delver with his spade upthrows,
And culls them, wond'ring, from the hallow'd ground."

Kensington, kindly classified and reported upon them. Of fourteen different specimens which he examined, he declared that seven were the bones of seabirds, and the remainder those of mammals, none of them human. The result of this examination shattered irretrievably the pigmy theory which had been entertained from the sixteenth century onwards, and during an unknown period previously. These seabirds and mammals formed beyond doubt the dietary of those who inhabited the subterranean chambers. Even at the present day, seagulls are used for human food at the Butt of Lewis.

It may here be observed that the present name of the isle is Luchruban, which is practically identical with the name *Luchorpáin* or *Luchrupáin*, by which the diminutive people of Irish legends are known. It is impossible to say when the old name "Isle of Pigmies" disappeared. Probably the modern name was given to the isle by natives of Ireland, who, according to Captain Dymes, were attracted to the spot by the fame of the "pigmies'" bones, for which they digged diligently. Martin Martin, who wrote an account of the Outer Hebrides as they were at the end of the seventeenth century, calls the pigmies *Lushirdan*, which is the same word as the modern Gaelic and Scots *Luspardan*, derived from *Lugh-spiorad* = little spirit. In Blaeu's well-known map, the name of the isle appears as *Ylen Dunibeg*, or Isle of Little Men.

I discovered after diligent inquiry that a local tradition exists at the present day about the pigmies of Luchruban. According to this tradition, the pigmies (who are called "Spaniards") came to Lewis 500 B.C. In the year 1 A.D. "big yellow men from Argyll" drove the pigmies from Cunndal, a cove near Luchruban, to the latter island. The pigmies, it is stated, lived on "buffaloes," which they killed by throwing "sharp-pointed knives at them." (A split ox-bone was among the remains found at Luchruban.)

We have here, I believe, an account of the small dark Iberian or non-Celtic aborigines being invaded by the tall fair Goidels, or early Celts of the Bronze Age, tradition thus agreeing with the results of the latest ethnological research. At Cunndal, mentioned in the tradition, I happened upon a number of hut-circles; and the conclusion I have formed is that these were the dwellings of the so-called pigmies, some of whom may have used the subterranean structure at Luchruban for greater security, or for winter habitation, or other unascertained purpose. It is possible that subsequently it may have been used as a *diseart*, or hermit's retreat, in which case the smaller chamber—the "chapel"—was probably the oratory of the recluse.

It seems fairly obvious that these aborigines were a short-statured race, who may have been contemptuously called "pigmies" by their supplanters, a taller race; and that the name has been perpetuated in a literal sense. The tradition doubtless long antedated the first discovery of the small bones, the finding of which would confirm the story about the diminutive people who were said to have lived in the neighbourhood.

Tradition is a good servant, but a bad master. Nearly always, if not invariably, it has an historical basis upon which, not infrequently, is

reared so fantastic an edifice that the solidity of the foundation is apt to be overlooked. To use another simile, it is the rubbishy matrix of myth, in which is embedded the pure gold of fact. Thus we have in the Goidelic legends impossible stories about *Fomorians* or giants, and *Luchrupáin* or pigmies, which we dismiss with an incredulous smile, forgetting that at the kernel of this traditional lore there are facts of ethnological significance. For the so-called giants and pigmies are but the tall and the short peoples of prehistoric times, magnified and minified respectively by the exaggeration of tradition.

That, for example, the little dark men of the Isle of Pigmies are not without representatives at the present day appears to be demonstrable. Writing on the different races in Lewis, Dr. Beddoe describes the characteristics of the three clearly-defined types which he observed there. Two of them, the Norse and the Celtic, need not detain us. The third he describes as a "short, thick-set, snub-nosed, dark-haired, often even dark-eyed race, probably aboriginal, possibly Finnish." It is not assuming too much to suppose that we have here the representatives, with obvious modifications, of the so-called pigmies of tradition. The racial type in Ireland which seems to approximate most closely with Dr. Beddoe's short dark people is sometimes identified with the legendary *Firbolg*; and place-names in the Hebrides seem to offer confirmation of the Irish account of the *Firbolg* having been driven from Ireland to the Scottish islands by their conquerors, the *Tuatha-de-Danaan*. These *Firbolg* were conceivably of the same stock as the Finnish *Bulgars* who conquered and gave their name to Bulgaria.

It is noteworthy that, while Celtic folk-lore of modern times is full of giants or *Famhairean* (*Fomorians*), there is a curious disappearance of the pigmies or *Luchrupáin*. The explanation appears to be simple. In the later stories the pigmies figure as fairies, in which entities the folk-lore of the Celts is peculiarly prolific. If we are to believe an ancient tract quoted by Professor O'Curry, the Irish fairies were originally the *Aes Sidhé*, a tribe of hill-dwellers endowed with flesh and blood like ordinary mortals. Thus we discover the origin of the *Daoine Sith*, the fairies of the Highlands of Scotland. "Fairy-mounds" is but the later name of the hill-dwellings of the ancient Irish tribe; and the tales of fairies popping in and out of their green abodes are but memories of the small-statured people who, "long, long ago," similarly appeared and disappeared from their subterranean dwellings in the hillocks. The Highland fairies are sometimes called *Daoine Beaga*, or little men, exactly the name applied to the Isle of Pigmies in Blaeu's map. The Isle of Pigmies itself is a round hill, its summit covered with short sea-grass of a vivid green; an ideal "fairy-mound" in point of fact. If we examine the Ballad Minstrelsy of Scotland we find in such ancient ballads as "The wee wee man," "As I went out on a Monday," "The Elfin Knight," and others, the same human note running through the descriptions of the so-called fairies. They are simply the Pechts or Pets (little men) of tradition, who are generally confused with the Roman *Picti*, or painted people, of history.

Reverting to the ethnological aspect of the question, it appears to

be capable of demonstration that the Celtic pigmies and fairies were a people of Finnish or Ibero-Finnish origin. I have already noticed Dr. Beddoe's suggestion that the short people of Lewis are of this stock. No one who has read Professor Sven Nilsson's *Primitive Inhabitants of Scandinavia* can help admitting the cogency of the arguments by which he seeks to prove that the pigmies of tradition and the dwarfs of the Sagas belonged to the same race as the Laplanders (or true Finns) of the present day.[1] His proofs are summarised in ten reasons which, collectively, appear to me to carry conviction. He emphasises the reputation for sorcery enjoyed alike by the dwarf race of tradition and the Lapps; and their magic was of a kind analogous to the *sian*, or the power of producing invisibility, which was attributed both to the *Daoine Sith* or fairies of the Highlands, and to the more mundane Highlanders who imposed upon their credulous neighbours a few generations ago. The "Lapp-shots" of the Swedish peasantry mentioned by Professor Nilsson are similar to the "elf-shots" of Ireland and the Highlands, both being simply the flint arrow-heads of a neolithic race. In Lewis, fairies are sometimes called *Muinntir Fionnlagh*, literally "the Finlay people," a designation which has baffled folk-lorists. It is not improbable that this name, which nobody can explain as applied to fairies, connects the latter with the undersized Finnish aborigines of whom they became the representatives, and that the meaning of the term is simply "the little Finn people." The Lewis fairies, moreover, are sometimes represented as engaging in agricultural pursuits, which suggests a traditional people who tilled the fields like their Celtic and Norse successors. So, too, the stories in Lewis about "fairy-dogs," concerning which startling beliefs were brought to light in the Law Courts only five years ago, appear to have a common origin with the vulgar credence in the magical qualities possessed by the Lapp dogs, as well as by their owners.

Perhaps the most striking evidence in support of the theories here set forth consists in the marked similarity between the *gammar* or huts of the Lapps at the present day, and the underground chambers in the Hebrides and elsewhere in Scotland, such as those of the Isle of Pigmies. I believe that this type of dwelling is in modern times peculiar to the Lapps and cognate races. The late Mr. J. F. Campbell of Islay, who knew both Lapland and the Hebrides well, has shown that a Lapp hut which he described was practically identical with an underground dwelling which he had examined in Uist not long before.

There appears to be a further link in certain customs common to the Lapps and the Hebrideans. For example, the Lapps, who have always been regarded by their neighbours as an uncanny folk, claimed, and possibly still claim, power over the elements. This is a phase of magic which was by no means confined to them; but one expression of it is, so far as I know, peculiar to Lapland and Lewis. They sold favourable winds to superstitious mariners, who were provided with magic cords, containing a number of knots, the loosening of which gave

[1] It may be worthy of mention that in Foley's *Dictionary of the Irish Language* one of the names for dwarf or pigmy is *Leappacán*.

whatever force of wind was desired. A few generations ago there were in Stornoway, the capital of Lewis, several old women who sold favourable winds, and employed precisely the same method of knotted cords for imposing upon credulous sailors.

There appears to be no reasonable doubt that the "Finn-men" of Shetland tradition furnish a further link in the chain of evidence by which I have sought to bind together pigmies, fairies, and Lapps. The Shetland Finns were believed to be capable of taking the form of marine animals, equally with that of human beings; and there are stories told of captured Finn-women who were wedded and bore children to their captors. A correspondent of Karl Blind informed him that there are people in Shetland who pride themselves on their descent from a Finn ancestress. In the Orkneys, too, the Finn tradition has a place. Wallace tells us that in 1682 one of these Finn-men was observed in his little boat, made of fish skins, at the south end of the Isle of Eda. Brand also, writing in 1700, states that a Finn-man had been seen at Stronsay within a year of his visit, and another, a little later, at Westray. A Finn-man's boat, with its oar and a dart used for killing fish, was found in the Orkneys and sent to Edinburgh, where, I believe, it is to be seen in the Museum of Science and Art.

All these facts, taken collectively, appear to point to the irresistible conclusion that the existence in prehistoric times of a Finnish or Lapponic race in the British Islands is an assumption which is far from being unwarrantable. And that the pigmies and fairies of folk-lore are but the misty memories of that race, which was first minified and then spiritualised by the legends of an imaginative people, is not less capable of belief.

GEOGRAPHICAL NOTES.

Europe.

Survey of the Oeschinen-See.—Herr Max Groll has sent us a very interesting pamphlet containing an account of his survey of the Oeschinen Lake in the Bernese Oberland, an account which he presented as a thesis to the Philosophical Faculty of Bern University in October 1903, but which has only been recently published. Visitors to Kandersteg and the Gemmi Pass will remember the Oeschinen valley and its little lake as lying to the east of the village of Kandersteg, the beautiful lake being surrounded by a series of snow-clad peaks, notably the Blümlisalp (3670 metres), the Doldenhorn (3647 metres), and the Dündenhorn (2863 metres). Herr Groll has made a detailed survey of the lake, similar to those which have now been carried out on so many lakes, both in Scotland and abroad, but the paper is mentioned here not because of its details, but because it affords a beautiful illustration of some of the facts of physical geography. The lake, which is fed by

several glacier streams, has no visible outlet, though there is evidence to show that the Oeschinenbach, which appears further down the valley, rises from springs which represent the outflow of the lake.

The origin of the lake is very interesting. The Oeschinen valley runs east and west, and is a strike valley; the rocks, which are Eocene and Mesozoic limestones, dipping into the trough-shaped valley at either side. The dip on the south side of the valley is such that, as the valley was deepened by erosion, the rocks at this side were undermined. In consequence, at some unknown period, extensive rock-slides took place from the mountain wall which bounds the Kandertal and the minor Oeschinental on the south-east, and the mass of debris slid forwards until it not only partially blocked the Kander valley, from the present site of Kandersteg to Kandergrund, but also blocked the lower part of the Oeschinental, and pushed up the mound which now dams the east end of the Oeschinen-See, thus causing the lake by blocking the drainage of the valley. Visitors to the region will remember the Bühl below Kandersteg, as well as the mound which lies at the lower end of the Oeschinen-See: both of these are remnants of the landslip described above, and not, as has been supposed, moraines. Both are composed of rock-rubbish, not solid rock, and the consequence in the case of the Oeschinen-See is that the water sinks through the loose material, instead of forming a stream on its surface. But this loose material acts as a filter-bed, and the result is that while the affluents of the lake are loaded with rock-waste, the springs which feed the Oeschinenbach are absolutely clear. Therefore all the rock-waste carried into the lake is retained there, and as its affluents are glacier-streams, observations on the rate of deposition in the lake will afford a means of estimating the rate of glacial erosion.

The date at which the landslips occurred can only be approximately ascertained. The fact that the mounds in the Kandersteg and Oeschinen valleys, mentioned above, contain remains of trees, indicate that it did not occur during the glacial period, and there is every reason to believe that it was post-glacial. In brief, the Oeschinen Lake is an admirable example of a lake formed by the blocking of the drainage of a valley by a rock-fall.

Owing to the height of the lake above sea-level it shows some very interesting variations in volume according to the season of the year. During the cold months of the year no additions are made to the water-content, for the affluents are not running, and the precipitation takes the form of snow, which falls on the top of the lake ice. But during this period the leakage by underground springs continues, so that in winter the level of the water falls. The following figures show the differences between the summer and winter conditions:—height above sea-level, summer, 1581 m., and winter, 1566 m.; length, 1700 m. and 1500 m.; greatest breadth, 950 m. and 850 m.: greatest depth, 56 m. and 41 m. The depth even in winter is thus considerable as compared with the size, and as compared with the other high Alpine lakes which have been measured. The slope of the bottom is very regular and uniform, interruptions of the regularity only occurring

where deltas form at the entrance of streams, and where the mound which dams the lake projects into its bed at the west end.

A British "Glacier."—In *Symons's Meteorological Magazine* for March, the Rev. R. P. Dansey draws attention to an accumulation of snow on Ben Nevis which may prove on further examination to have some at least of the characteristics of a glacier. The summit plateau of Ben Nevis terminates in a magnificent series of precipices, nearly two miles in length, overlooking the NE. face, and rising above the Alt-a-Mhuilinn corrie. On the other side of the corrie rise the steep scree-covered slopes of Cairn Mor Dearg (4012 feet), which sweeps round the head of the corrie to join Ben Nevis on the east by an arête which never falls below 3478 feet. The corrie is thus surrounded on every side except the north by very high ground, which shuts the sun out from its deep recesses. Further, the cliffs on the Ben Nevis side intercept the warm Atlantic winds, so that the temperature of the corrie is always low. It is in this corrie that the great, and apparently permanent, accumulation of snow already alluded to occurs. The snow which falls on the precipices above is largely swept by winds into the corrie, while the precipitation in the corrie itself is high. About the beginning of July the snow usually disappears from the summit, except drifts, but even in September, the minimum period for snow in the corrie, there is a great depth of snow remaining. There are two great areas of this permanent snow, and a measurement of the larger of the two in last August showed a length of 300 feet, and an average breadth of fifty yards. The surface was hard and ribbed like the névé of the Alps, while between the rocks and the snow at the side it was possible to look down into the bergschrund to a depth of fifty feet in many places. It is proposed to study the snow-patches in more detail during the present season with the object of finding whether any movement exists, comparable to that of a glacier.

Survey of Iceland.—In connection with the note on this subject, quoted from *Petermann's Mitteilungen*, which appeared in our March issue, p. 155, we have received the following from Mr. T. S. Muir, of the recent Scottish Expedition to Iceland:—"Referring to the beginning made last year with the survey of Iceland, it is stated in the March *Magazine* that one result of the work was to show that the highest point of the island is Hvannadalsknukr, which is 2120 metres, and not, as has been hitherto supposed, the Öraefa Jökull, which is only 1959 metres. Now the Öraefa Jökull is the name given to a huge mountain mass, seen so well from out at sea, and a conspicuous landmark for the south coast, which contains several peaks, of which Hvannadalsknukr is the highest. We understood from one of the officers of the survey whom we met on our expedition that their result of 2120 metres was merely a correction of the old and inaccurate measurement which certainly shows a considerable error. The word 'Jökull' is in Iceland applied indifferently to snowfields, isolated ice-mountains, a mountain mass, and true glaciers, although for the latter there is another word, which, however, is not in

common use. The Öraefa Jökull, then, corresponds with Monte Rosa, and Hvannadalsknukr is its Allerhöchste Spitze."

The Gorge of Escoáin.—In the *Boletin de la Real Sociedad Geográfica* of Madrid there is an interesting contribution by M. Lucien Briet on the Gorge of Escoáin, a district tucked away under the Spanish side of the Pyrenees, which should attract the real traveller and the geologist. It lies in a region difficult of access, unknown to the ordinary tourist, frequented rather by the occasional explorer. The province is Arragon; the county, as we should say, Huesca, a country immortalised by Cánovas del Castillo in his *La Campaña de Huesca*, in which a magnificent description of this very scenery is given in the account of the flight of Don Ramiro, the Monk-King, from his rebellious nobles, and his meeting with the Count of Barcelona.

Escoáin lies somewhere between Mont Perdu and the Maladetta, due north from Zaragoza; it is not mentioned in Baedeker, nor in the ordinary map, but it has been visited and described by Wallon, by Schräder, and by others. Schräder gave a full description in the *Annuaire* of the French Alpine Club in 1877, in which he mentions having started from Huesca. It can also be approached from the French side by way of Gavarnie, but this has its difficulties, as the traveller has to traverse Mont Perdu.

The writer claims that, while other travellers were content to view the Gorge from above, he was the first, in 1903, to follow the river up from below, and to track it to its source in the middle of this magnificent Barranco. From Bielsa, which we take it is the last point to be reached by carriage, Escoáin is about six hours distant, accessible only by a bridle-path, which follows the course of the Cinca, diverging into its tributary, the Yaga, the stream which has its source in the Gorge.

The scenery would seem to consist of a plateau of limestone, partly the Pyrenean marble, which has in other times been subjected to glacial and water action, and has been cut out into "cañons" of great depth; isolated masses of rock have been hewed and carved into the fantastic shapes of castles and fortalices, most quaint and beautiful to behold. In one of these gorges M. Briet noticed a curious effect of the ice erosion, an effect which he had also seen in Marboré, in France. On the floor of the Gorge, which was covered with vegetation, were what appeared to be boulders, smooth, shining and white, some so close that one could step from one to the other, looking as if they had been loose rocks deposited at random by ice action, but which in reality were simply deeply-furrowed erosions, cut out by the ice, and filled up by the luxurious vegetation during the ages.

The village of Escoáin merits some notice, both because it is typical of the Pyrenees, and because the traveller depends on it for his accommodation. It lies on a plateau close to the Gorge, and consists of eleven houses, of which that belonging to the widow of Don Jacinto, the old host and guide, is the best. The dwelling-house and the granary face one another, and the oven is separate from both. The porch supports a covered loggia, and on the floor is seen a hatchet not far from

a tree trunk, from which are daily cut the resinous torches which are still used in upper Arragon to produce light. From the ground-floor, which serves both as dormitory and hall, a dark staircase leads to the dining-room, behind which is the kitchen, beyond which again are two bedrooms, where probably the guests are lodged. All was very comfortable and presumably clean, and, contrary to expectation, the food excellent, to those accustomed to Spanish cookery. The writer mentions having been regaled with soup, with butter, bacon, pigs' feet, excellent lentils, omelettes, and even fricassée of chicken. The cheese made of ewes' milk he describes as very good, not unlike the little Camemberts sold in cases. The wine came from a distance, and tasted of the skin. Altogether the voyager may make himself fairly comfortable, and is not likely to starve.

Then follows a vivid description of the Gorge itself; so steep is it that only goats descend, and indeed it is they who have made the paths and shown where the approaches are accessible.

Altogether the article gives a very pleasant account of a district very little known, which may tempt, not the ordinary tourist and his Saratoga, but the genuine traveller who wishes to get out of the beaten track, and to study a primitive people in their country.

Africa.

The Township of Livingstone.—In connection with the article on the economic development of Rhodesia, which appeared in our March issue, the following note, from a correspondent to the *Glasgow Herald*, is of interest:—"The railway, which is to do so much for Rhodesia, was extended as far as Victoria Falls on April 25, 1904. The directors of the British South Africa Company had contemplated the founding of a township in the vicinity of the Victoria Falls long before the railway reached that point, but it was not until lately that much has been heard regarding the chosen site. The site of the township has been fixed at a spot about three miles from the Falls in a northerly direction, and on the left bank of the Zambesi. The town has, of course, been given its name, Livingstone, after the great explorer and pioneer of civilisation. He it was who gave the name to the Falls, and Livingstone Island is not far distant. That the site has been well chosen, with every scope for development, is readily admitted. The future of this township will depend appreciably on the opening up of North-Western and North-Eastern Rhodesia by the railway which is being projected *via* Kalomo to Lake Tanganyika, and which has already been laid down for about a dozen miles beyond the Falls, and runs close to the new township. The relation of the site to the Victoria Falls is one which commends itself in almost every way. It has long been intended and resolved that this vast body of water, which has been for ages discharging itself into the sea, should be utilised for the economic development of the extensive mining areas about the Zambesi Valley. The importance of the Falls cannot be exaggerated; here is constituted the greatest water-power in the world. During the flood season—January to April—it has been

calculated that about 35,000,000 horse-power is continually being wasted, and it is understood that the Directors of the British South Africa Company purpose making use of this great power, as has been done at Niagara, for the generation of electricity. Livingstone will be the centre of an important district, in which agricultural, milling, metallurgical, and cotton industries will be carried on under favourable conditions. Everything seems to point to this new township becoming one of the chief industrial centres, if not the chief town, of Rhodesia."

On April 1 the great bridge over the Victoria Falls was linked up.

America.

The North-east Coast of Brazil.—Professor Branner delivered his presidential address before the Geological Society of America in December last, and chose for his subject the geological and geographical peculiarities of the north-east coast of Brazil. The most peculiar feature of the coast is the series of hardened sand-spits which occur at the mouths of most of the rivers. These spits consist of quartzose sand which has been cemented together into a hard, solid rock by means of calcium carbonate brought down in solution by the rivers, and precipitated by contact with the water of the ocean, which here possesses a high degree of salinity. This hardening extends to a depth of several feet, and in many instances has been of great economic importance through the formation thereby of natural breakwaters, forming safe harbours, as at Pernambuco. The spits contain many fossils, all of which belong to living species. A second coast feature of importance is the series of coral reefs, which sometimes alternate with the sand-spits, and sometimes are associated with them. The reefs seem to be comparatively thin, but many of them are very wide. It would appear that the coast has remained stationary for a considerable time, for the reefs reach to the upper limit of coral growth, where they show broad areas of dead coral within the fringes of living animals.

Polar.

Land and Water in the Arctic Region.—Dr. J. W. Spencer read a paper before the American Association for the Advancement of Science last December, in which he spoke of the great improbability that land will be discovered in the vicinity of the North Pole. Dr. Spencer said that Nansen discovered the deep Polar Basin, which is sharply defined by a continental shelf, 300-350 miles wide, lying north of Siberia and continuing to Spitzbergen, which lies at its very edge; and this, in his opinion, is proof that no land is to be expected rising out of the basin until the continental shelf on the American side is reached. The broad Siberian shelf continues even north of Behring Straits, and soundings exist which suggest the position of its border. Alaska encroaches upon the shelf to near its border, thus reducing its breadth to probably fifty miles. Beyond Alaska the Mackenzie River empties itself into the Beaufort Sea by a fiord known to a depth of 1140 feet, while another behind Banks Land reaches a depth of 1836 feet, and lies far

within the line of the islands. Among the islands another of the fiords is known to reach a depth of more than 2400 feet. All these features, in the opinion of the author, go to prove that the archipelago of high mountains is only a dissected plateau, now sunk, and with drowned valleys between the islands, while these valleys incise the continental shelf in such a fashion as to indicate that the shelf itself cannot extend far beyond the outer line of the known islands. A sounding about thirty miles north of Grinnell Land giving a depth of 432 feet, further suggests that the edge of the shelf is being reached, for the outer margin of this seems to be limited by a depth of about 300 feet beneath sea-level. From these submarine topographic features, the author concludes that no important islands exist beyond the line of the known archipelago, and that the deep Polar basin reaches for 300-350 miles from the Pole, approaching the American continental shelf to the north of Grinnell Land. With these views of Dr. Spencer's should be compared those put forward by Dr. Harris, who holds the contrary opinion that there is a tract of land in the vicinity of the Pole (cf. this *Magazine*, xx. p. 320).

Proposed Biological Station in Greenland.—In connection with this station, the plans for which were outlined in our February issue (p. 105), attention may be drawn to a long letter in *Science* for Feb. 3, in which Dr. Pehr Olsson-Seffer gives a full account of Mr. Porsild's proposals. It is pointed out that the southern coast of Disko has the richest flora and the most luxuriant vegetation in northern Greenland. Further Cretaceous and Tertiary formations, with rich deposits of fossils, occur in the neighbourhood, while the inland ice, here easily accessible, glaciers in all stages, fiords, rivers, and the open sea, all afford excellent opportunities for investigations. All the main features of Arctic climates are found here. The sun does not rise over the horizon for over six weeks, and for a still longer period in summer does not go down. There are many questions connected with plant physiology which still await investigation in such Arctic climates. Such facts as that Arctic willows bud and flower as soon as they reach above the surface of the snow, while their lower parts are still frozen, are as yet unexplained. Similarly, the phenomenon of plants growing and flowering on steep mountain sides, where they are exposed to a temperature of 30° C. in the daytime and several degrees under zero at night, and to extremely low temperatures in winter, without any snow covering, are puzzling. The succession of plant communities on new soil, left bare by the ice, is a problem which can probably be better studied in Greenland than anywhere else at the present time, and is of much interest, because the conditions which prevail there now were once found in the glaciated areas of both the north and south hemispheres.

Other investigations could be made in connection with meteorology and geology. Near the proposed site for the laboratory are mountains 2000-3000 feet high, and easily accessible. It is proposed to place self-registering instruments in a hut on the top of the mountain, so that simultaneous readings could be had from near sea-level and from the

mountain—a point of great importance. Among problems of geological interest may be mentioned the study of glaciation and of erosion, which takes place with great rapidity in the northern part of the country. Certain parts of the country are known to be sinking, and in the basaltic regions of North Greenland earthquakes are not infrequent. In investigating both sets of phenomena, a trained observer, resident on the spot and supplied with the necessary instruments, could render valuable service. In zoology plankton researches could be undertaken, and a series of observations on the periodicity of the plankton, together with data on salinity and the temperature of the sea-water, would be of great interest. On the whole, there seems no doubt that such a station would give opportunity for the investigation of a large number of important problems, and would be an invaluable auxiliary to the work of the various Arctic expeditions.

General.

Plans for obtaining Subterranean Temperatures.—The Carnegie Institution of Washington has granted to Professor C. K. Gilbert an appropriation for preliminary expenses in connection with a scheme for obtaining a series of subterranean temperatures, and a pamphlet has been sent to us by Professor Gilbert giving a report of progress in the preparation of plans up to date. In this pamphlet the author points out the importance of an exact knowledge of the normal increase of temperature with depth in connection with many problems of geophysics. The facts hitherto obtained have all been made in connection with borings carried out for economic purposes, as in sinking wells, mines, and so forth, and there are many reasons why these are unsatisfactory from a scientific standpoint. In the first place all borings for economic purposes, whether for water, minerals, gas or oil, have been necessarily made in varying instead of homogeneous material. Such borings have therefore presumptively encountered changes in temperature gradient arising from differences in material, and as it is not practicable to separate such variations of gradient from the variations dependent merely on depth, the latter variations cannot be deduced from records now in existence, and can be afforded only by a deep boring in homogeneous material.

The conditions to be satisfied in the selection of a site for a special boring are numerous. In the first place, the rock in the locality chosen must be uniform throughout the whole depth of the boring. Again, the circulation of subterranean water is a factor which greatly impairs most records of subterranean temperature, and there are few districts of sedimentary rocks exempt from such circulation. Such circulation is promoted by cracks of the rocks and by porosity, so that the rock in the site chosen must be continuous or massive and impervious. Again, as the topography of the surface exerts an important effect on the subjacent isogeotherms, it is necessary that the site chosen should be a plain or surface of low relief, and should be one which has not received a heavy deposit during the later geologic periods. Other conditions which must be satisfied are stable surface conditions of temperature, a locality distant

from a locus of volcanism, and one free from recent organic disturbance. Professor Gilbert finds that the Lithonia granite district in Georgia satisfies all these conditions, and he recommends that a boring to the depth of 6000 feet be undertaken here. If the Carnegie Institution grant the necessary funds, and the scheme prove practicable, the resulting observations should prove of great interest.

The Royal Geographical Society's Awards.—It is announced that the Victoria Research Medal, which was instituted on the death of Queen Victoria, and is bestowed as occasion may arise in recognition of distinguished service to the cause of geographical research as distinguished from exploration, has been bestowed this year upon Mr. J. G. Bartholomew, one of our honorary secretaries. The announcement of the award states as the reason of the bestowal of the medal that Mr. Bartholomew, "during many years, has done more than any other professional cartographer to raise the standard of cartography in this country. He has edited and issued large atlases of England and Scotland; he has planned and issued the first volume of a great physical atlas which will take the first place among works of its kind; he has for years been collecting material for a complete atlas of the British Empire. All this has been done at his own expense, entailing the expenditure of thousands of pounds, which he can never hope to recover."

Of the other medals, the Founder's Medal goes to Sir Martin Conway, and the Patron's Medal to Captain Ryder for his work in connection with the Tibet Mission.

British Association Meeting.—The full list of the officers in Section E (Geography) is now available, and is as follows:—*President*—Admiral Sir W. J. L. Wharton, K.C.B., F.R.S. *Vice-Presidents*—J. Scott Keltie, LL.D.; Douglas W. Freshfield; H. C. Schunke-Hollway, F.R.G.S., F.S.A.; E. H. V. Melville. *Secretaries*—A. J. Herbertson, Ph.D. (*Recorder*); H. Yule Oldham, M.A.; A. H. Cornish-Bowden; F. Flowers.

Commercial Geography.

The Potash Industry of Germany.—The American Consul-General in Berlin devotes a recent report to the German potash industry. A large area, including parts of Schleswig-Holstein, Mecklenburg, all the plains as far as the Weser, the Magdeburg-Halberstadt basin, and parts of Thuringia, possesses enormous beds of rock salt, underlaid and intermixed with deposits of potassium minerals, held in place and preserved by substrata of impermeable clay. These give to Germany the only workable and practically inexhaustible supply of mineral potash in the world. The deposits consist mainly of carnallite and kainite. The former is easily soluble, and therefore adapted for factory work. Muriate of potash and various other products are derived from it. Kainite does not absorb water, and is ready for use as a fertiliser when it is extracted; it is also used for the manufacture of several concentrated salts. These minerals were first discovered in 1857 underlying salt mines which had

been worked for centuries, and experimental borings showed that the deposits existed in the whole valley of the Elbe from Mecklenburg to Thuringia. By 1868 a syndicate had to be formed to attempt to restrict the production; but the market grew steadily both in Germany and abroad. In 1901 the exports to the United States alone reached nearly 350,000 tons of various raw and manufactured products, which were chiefly used, in combination with native mineral phosphates, for the manufacture of fertilisers. In 1903 the German potash mines produced 1,557,243 tons of kainite, worth more than one million sterling, and 2,073,771 tons of other potash salts, valued at nearly the same amount; 501,385 tons of kainite and sylvinite were exported, the United States taking fifty-four per cent. of the total exports. The remaining million tons of crude mineral were used as fertilisers in Germany, "with results so startling and incontestable that they may well serve as an object-lesson for agricultural scientists in other countries." The consumption of potash salts in German agriculture trebled in the ten years ended with 1903, and the Consul-General gives many figures to show the favourable result of their employment in the production of various crops. "The potash deposits of the Elbe valley," he adds, "are, in fact, the sheet anchor of German agriculture, one of the main grounds of its efficiency being that it restores to exhausted soils some of the essential elements of fertility which under modern conditions are lost in the sewage of towns and cities, and find their way back to the ocean whence they originally came." The various refined and concentrated potash salts, which play such important parts in many branches of chemical manufacture, are chiefly derived from carnallite, and from a much rarer mineral, sylvite, which is practically pure potassium chloride. These salts, in different combinations, are used in printing on cloth, photography, bleaching, dyeing, glass and soap making, freezing compounds, poison antidotes, explosives, and in innumerable other ways. It is notable that, while Germany exports potash fertilisers in such large quantities to the United States, she is obliged to import from the latter three-fourths of the mineral phosphates she requires. In 1902 Germany imported 430,425 tons of natural phosphates, of which 320,305 were from the deposits in the Southern Atlantic States of the Union, while the remainder went from Algeria, Tunis, Belgium, and Malacca.

NEW BOOKS.

EUROPE.

Cambridge Historical Series. Scandinavia. By R. Nisbet Bain. Cambridge: At the University Press, 1905. *Price* 7*s.* 6*d.*

The latest volume of the Cambridge Historical Series deals with the history of Scandinavia, *i.e.* Sweden, Denmark, and Norway, from 1513 to 1900, and is by Mr. R. Nisbet Bain. It was no easy task to compress the political history of three different though adjacent countries during a space of four centuries into a volume of less than 450 pages, but in the capable hands of Mr. Bain the task has been fairly satisfactorily achieved, and will be appreciated by all students of history. We

have only to mention the names of a few of the leading characters who appear in these pages to recall to our readers the fact that the history of Scandinavia is full of romance: Gustavus Vasa, Gustavus Adolphus, Charles XII., Bernadotte among the men of Sweden; Christina, Sophia Amelia, and Caroline Matilda among the women; and Richelieu, Mazarin, Peter the Great, Catherine II., Cromwell, and Napoleon among outsiders who have influenced its history. To the statesman and diplomatist of to-day many a lesson can be learned from the successes and failures of Oxenstern, Griffenfeld, Ulfeld, and Struensee. The paramount importance of supremacy at sea is abundantly evinced throughout the whole volume; while the soldier will read with renewed interest the notices of such distinguished generals as Tilly, Wallenstein, and Wrangel. It is difficult for us of the twentieth century to realise how important a part Sweden played in the councils of Europe in the beginning of the eighteenth century. "In November 1700 died Charles II. of Spain, bequeathing the whole of the possessions of the Spanish monarchy to Philip of Anjou, the second grandson of Louis XIV., who thereupon openly repudiated the partition compact which he had made with the maritime powers, and declared his intention of putting his grandson into the full possession of his rights. A war between France and the maritime powers was now only a question of time; and both sides looked to Sweden for assistance. The competing French and Imperial ambassadors appeared in the Swedish camp, while the English and Dutch ministers were equally busy at Stockholm. The chancellor, Benedict Oxenstjerna, saw in this universal bidding for the favour of Sweden a golden opportunity of 'ending the present lean war (*i.e.* the war against Peter the Great. The victory of Narva took place on the 21st November 1700), and making his majesty the arbiter of Europe'; but Charles met all the representations of his ministers with a dogged, disconcerting silence." The decay and fall of Sweden, like the decay and fall of Spain, is one of the saddest pages of history. And even yet, as we learn from the volume now before us, its troubles are by no means over. It is now afflicted with the miserable incubus of a dual government, such as obtains with equally disastrous results in Austria. We must add that the volume is equipped with some very useful maps.

ASIA.

Holy Himalaya. By G. Shennan Oakley, M.A. Edinburgh and London: Oliphant Anderson and Ferrier, 1905. *Price* 5*s.*

Under the somewhat inappropriate title of *Holy Himalaya*, the Rev. Mr. Oakley, of the London Missionary Society, has given to us a pleasant and interesting account of Kumaon and Garhwal, the most northerly tract of the United Provinces of India. In his introduction the writer says, "The purpose of the work is far from being wholly a controversial one, yet I shall be very glad if it helps to prove that India needs a better faith"; and we apprehend that no one, acquainted even superficially with the religious conditions of India, would hesitate to agree with him in his general opinion. It is only when Mr. Oakley comes to set forth his own views of how the better faith is to be provided and promulgated that he enters on contentious and debatable ground on which we, of course, cannot follow him. His descriptions of the scenery and the people of Kumaon taken from his own experience are graphic and interesting; he has compiled his historical sketch of the province from well-known official sources, and he writes with enthusiasm and sympathy on the various branches of his subject. It is natural that religious customs, beliefs, sayings, etc., should take up the greater part of his work; and we believe that to many besides Anglo-Indians who

have served in Kumaon his chapters on Ghosts and Godlings, Customs, and the Village Wiseacre will be most interesting and instructive. His specimens of folk-lore and proverbs are well chosen, and many of them cannot fail to arrest the attention of the reader. The work is embellished with a number of good photographs.

With the Pilgrims to Mecca. By Hadji Khan, M.R.G.S., and Wilfred Sparroy. London and New York, 1905. *Price* 12*s.* 6*d.*

From a note at the beginning of this work we gather that some four-fifths of it have already been published under the title of *The Great Pilgrimage*; nevertheless the present work is not "a mere republication. It is something far more than that; one-fifth of the book, and that the most interesting part of all, being absolutely new; while the whole of the remainder has been not only carefully revised, but also recast, and, to some extent, rewritten." The joint authors acknowledge their obligations to the editor of the *Morning Post* for permission to publish it in its present form. The first chapters are devoted to a glowing and enthusiastic description of Mohammedanism, and in the second part of the work we have the story of the pilgrimage to Mecca made by Mr. Hadji Khan in 1902. The Hadji describes himself as an Agnostic, but it is very evident he was from time to time carried away by the obvious sincerity and enthusiastic piety of those around him. His descriptions of the sights he saw are remarkably vivid and forcible. In the course of the pilgrimage he encountered the usual dangers from robbers and zealots; but far worse than anything else was the cholera, which broke out among the pilgrims and carried off hundreds, if not thousands, of victims. Neither the authorities nor the pilgrims had taken any precautions against the deadly disease; indeed, the sanitary conditions of the whole route of the pilgrimage are such that the wonder is that cholera does not break out every year. The pilgrim, with the assistance of Mr. Sparroy, has been able to give his readers a description of the Hag, which is equal to any of its predecessors, not excluding even the graphic and picturesque descriptions of Burckhardt and Burton. The third part of the book contains a description of the Mecca Bazaars.

The veteran Professor Vambéry has contributed a brief introduction to the book. In it he says: "The Haj is a most wonderful institution in the interest of the strength, unity, and spiritual power of Islam; it is a kind of religious Parliament, and a gathering place for the followers of the Prophet, where the sacred Hermandad is fostered despite all differences of race and colour, and whereas the temple in Jerusalem does often become the cockpit of different Christian sects, and the arena of bloody fights, which would fatally end without the intercession of the Moslem soldiers of the Padishah, we meet with perfect peace and concord in the court of the Kaaba, where the four sects have got their separate places without interfering with each other, and where Hanefites, Shafaites, Malekites, and Hanbalites pay simultaneously their veneration to the founder of their religion." We are bound to remark that "the peace and concord in the court of the Kaaba" referred to in such glowing terms by the Professor were not so conspicuous in 1902. The book is embellished with a number of good photographs.

AMERICA.

The Purple Land. By W. H. Hudson. London: Duckworth and Co., 1905. *Price* 6*s.*

It is difficult to classify this book, and equally difficult to imagine why it was ever written. The Purple Land is the modern republic of Uruguay, known some

time ago as Banda Oriental, and the hero of the book is an Englishman of a stamp which we trust is not very common even in the semi-civilised republics of South America. He tells us he eloped with the daughter of a Spanish gentleman from Buenos Ayres, and so laid himself open to punishment by law much in the same way as a man does at home if he runs away with and marries a ward in Chancery. The couple fled to Monte Video, where he left his girl-wife with a convenient aunt, while he himself started off inland to find employment. He failed to find work; but in the course of his travels he came in for various adventures, in few of which was his conduct such as we expect to see in a newly married English gentleman. If it is difficult to imagine why such a book was ever written, it is still more difficult to imagine why, after a lapse of nineteen years, it has again been dragged out of the oblivion it deserved.

The Tower of Pelée: New Studies of the Great Volcano of Martinique. By Angelo Heilprin. Philadelphia and London: J. B. Lippincott and Co., 1904. Pp. 62.

With regard to the term "The Tower of Pelée" the author remarks: "No other name, it seems to me, more appropriately conveys the picture of the giant cone of rock, nearly 1000 ft. in height at the time of its greatest development, and 350-500 ft. thick at the base, which Pelée had bodily lifted and pushed out from its summit during a period of a full year and more. This extraordinary obelisk of lava, like a veritable "Tower of Babel" whose apex at the time of my visit, the middle of June 1903, reached a position of 5020 ft. above the sea, transfixed the newly formed cone of the basin of the Étang Sec, and rose to all purposes vertically above it, the two structures, products of the eruptions beginning in April 1902, having a full height of approximately 2300-2400 ft. As seen from the east-north-east on the quarter of Assier and Vivé, it presented the aspect of an acute pyramid; seen from the south or south-west it gave the appearance of a conical spire complicated by secondary spires, needles, or fingers, and showing a split or indented apical summit; while from the north-east and north it rose up a gigantic and nearly parallel-sided tower or fortress. From whichever side seen, it was an object of sublime magnificence; and in its condition of vapour clouds blowing out from its base and from the cone that supported it, with blue sulphur smoke curling its way along with these, it presented a spectacle of almost overwhelming grandeur, and one of terrorising effect which could hardly be matched elsewhere. None of the grand effects of Nature which I had before seen—the Matterhorn, the Domes of the Yosemite, the colossus of Popocatepetl soaring above the shoulder of Ixtaccihuatl, or the Grand Cañon of the Colorado—impressed me to the extent that did the view of Pelée's tower from the crater-rim on the afternoon of June 13."

Fine photos of the tower (by the author) and numerous other photographic illustrations (by him), and an interesting letterpress complete an instructive volume. Reproductions are given of fragments of manuscripts dealing with volcanic phenomena as part of a geological lesson, recovered from the débris at Saint-Pierre when 30,000 persons perished.

Geografia Fisica y Esferica de las Provincias del Paraguay y Missiones Guaranies. Compuesta par don Felix de Azara, Capitan de Navio de la Real Armada. Pp. cxxxii + 468. Montevideo, 1904.

Don Felix de Azara was born in Barbuñales, near Bolbastro, Spain, in 1746, and in 1781 was sent to South America as one of the Commissioners appointed to

delimit the frontier between the Spanish and Portuguese territories in the Parana basin. He then conceived the idea of compiling a map of Paraguay, and to this end spent thirteen years in travelling about the country, measuring his distances with care, and calculating the latitudes and the longitudes, the latter being referred to Asuncion as the prime meridian. The present work is printed by Sr. R. R. Schuller from a MS. in the National Library of Montevideo, and is published under the auspices of that institution. Another narrative of the travels of Azara was published in 1873 in the *Revista del Rio de la Plata*, but it differs in many respects from that now given to the public. The volume contains several maps and plans; but unfortunately the map of Paraguay, to which Azara alludes in his preface, has not been found. Sr. Schuller has contributed a large number of useful notes, and a long prologue on the Guarani and other tribes.

POLAR.

Early Dutch and English Voyages to Spitsbergen. Edited by Sir W. Martin Conway, F.S.A. London: Printed for the Hakluyt Society, 1904.

The Council of the Hakluyt Society are to be congratulated on having secured the distinguished geographer and explorer, Sir Martin Conway—to whom we offer our hearty congratulations on the honour recently conferred on him by the Royal Geographical Society—as the editor of the latest of their productions, viz. *Early Dutch and English Voyages to Spitsbergen*. In England, in the days of good Queen Bess, it was confidently, though erroneously, believed that Spitsbergen had been discovered by the illfated Sir Hugh Willoughby in the year 1553; but as a matter of fact it was discovered by the Dutch in the end of the sixteenth century. Its seas abounded in whales, walruses, etc., and so it soon became the scene of bitter contention between English, Scotch, Dutch, French, and other adventurers, who showed supreme contempt for such trifles as royal charters produced *ad libitum* by their rivals, and appealed with varying success to the ultimate tribunal of *force majeure*. The principal English company engaged in the whaling industry was "the Company of Muscovie Merchants of London," which in the winter of 1612-13 despatched a fleet of seven ships, one of them carrying twenty-one guns, to Spitsbergen, where they found whalers from France and Holland, as well as interlopers from England; and the first narrative in this volume is that of Hessel Gerritsz, in which, after an interesting account of the island and its products, he describes the high-handed proceedings of the fleet of the Muscovy Company, which drove away all the whalers of other countries from the island and took possession of their stores. In 1614 the English and Dutch established a sort of partnership or *modus vivendi* alongside of each other in the island, but this did not last very long. In 1617 the number of Dutch vessels trading, *i.e.* engaged in whaling, in the islands became so numerous that they had perforce to enter into the English harbours, whereupon quarrels arose, with the inevitable results of fighting and plundering each others' ships. In 1618 the Dutch sent twenty-three ships to Spitsbergen, while the Muscovy Company had only thirteen, a disproportion which gave an overwhelming superiority to the Dutch, of which they did not hesitate to avail themselves; and they treated the representatives of the Muscovy Company even more harshly than the Muscovy Company had treated their predecessors a few years before. The mishaps of the English traders at this time are set forth in some affidavits copied in the volume now before us from the Domestic State Papers of James I., 1618. In the year 1630 a boat's crew of Englishmen were left in Spitsbergen, presumably by accident. They were, of course, given up as lost, but they survived the winter, and were found by the

whalers on their return to the island in 1631. Meantime the whaling industry of Spitsbergen had become so profitable in Holland that the Noordsche Company of Amsterdam found it impossible, or at least inexpedient, to retain a monopoly of the trade; so they associated with themselves merchants from other centres in Holland and elsewhere, and set up a permanent establishment in Spitsbergen, which they called Smeerenburg, *i.e.* Blubber Town. Contemporary records indicate that some four thousand tons of shipping came annually from Holland to Smeerenburg. Quarrels, however, arose between the towns; and Braem, a Dane, took the opportunity of the absence of the Dutch to loot and destroy their warehouses. This led to the Dutch deciding to leave a detachment on the island, and the next narrative in this book is the diary of Van der Brugge, one of seven men who passed the winter of 1633-34 there. They spent their time hunting bears, reindeer, etc., and endured terrible sufferings from frostbite and scurvy, but they all survived, and so were more fortunate than seven other adventurers left in Jan Mayen, not one of whom survived the rigors of the winter. In the meantime the English Muscovy Company had fallen on evil days. It was plagued by interlopers from England and elsewhere, but above all by a Scotch company armed with a patent from Charles I., and the various parties were unable to reconcile their claims or effect a compromise like their Dutch rivals. Their disputes were referred to the Privy Council, who in its turn referred them to a Court of Admiralty, where they dragged on for years, apparently until the final collapse of the whaling industry in the time of the Commonwealth. We have compiled the above remarks from the introductions to the various narratives in this volume, contributed by Sir Martin Conway, and we are glad to observe that in one of them he announces he has written a history of Spitsbergen which he hopes to publish soon. All who are acquainted with Sir Martin's former literary productions will be prepared to give a very cordial welcome to his new work.

GENERAL.

The Principal Navigations, Voyages, Traffiques, and Discoveries of the English Nation. By Richard Hakluyt. Vols. ix., x., and xi. Glasgow: James MacLehose and Sons, Printers to the University, 1904.

The ninth volume of the new issue of Hakluyt's *Principal Navigations, Voyages*, etc., published by Messrs. MacLehose of Glasgow, is chiefly concerned with expeditions and adventures in North America in the sixteenth century. The first narratives describe an expedition to Florida by an unlucky Frenchman, Captain René Laudonnière, who, under the auspices of Admiral Coligny, hoped to secure in America a place where the unhappy Huguenots of France might be safe from persecution. After this we have curious accounts of some futile expeditions in New Mexico, made at the instance of Don Antonio de Mendoça, Viceroy of Mexico and New Spain. From New Spain the scene shifts to the Gulf of California, and we have a most interesting account of the memorable voyage of Francisco de Ulloa along the coast of California in 1539-40, undertaken by command of Fernando Cortez. After this we have the story of Sir Francis Drake's expedition in 1578 to California, of which he promptly took possession in the name of Queen Elizabeth, and named it Nova Albion. The last part of the book contains most interesting narratives by various Englishmen, *e.g.* Robert Thomson, John Chilton, and others, of their adventures in New Spain in the latter half of the sixteenth century. These narratives give much useful and interesting information regarding the people and economical conditions of the tracts through which the travellers

passed. Their real difficulty was not the natives, but the Inquisition. The unfortunate Job Hartop, a gunner in Sir John Hawkins' expedition in 1568, sums up his own mishaps in these words, "I suffered imprisonment in Mexico two yeeres. In the Contratatione house in Sivill one yeere. In the Inquisition house in Triana one yeere. I was in the Gallies twelve yeeres. In the everlasting prison remediles, with the coat with S. Andrews crosse on my back four yeeres. And at libertie I served as a drudge Hernando de Soria three yeeres, which is the full complement of twenty-three yeeres." Miles Philips in his narrative describes how he and sixty-seven companions were racked and scourged by the Inquisition, and three of them were burned to death in the city of Mexico for the crime of heresy.

In the tenth volume the scene of the voyages and adventures is changed to the Antilles, the West Indies, South America, and more particularly Guiana. The first expedition described is the voyage of Thomas Vert and Sebastian Cabot to Brazil in 1516, and then we have the three voyages of Sir John Hawkins in 1562, 1564, and 1567-68. There is also a stirring account of the famous expedition of Sir Francis Drake in 1586, when he sacked the cities of St. Iago and Cartagena. Certainly if the English had no reason to love the Spaniards, the latter had as little to love the English. Setting aside general and permanent grounds of quarrel, *i.e.* the difference in religion, and the fact that the English were deliberately intruding on rich and profitable lands, in regard to which the Spaniards entertained a *bona fide* belief that they were theirs alike by the laws of God and man, the injuries inflicted by the English buccaneers on their commerce and trade must have been enormous and most irritating. In this volume we have the story of a Captain Newport, who with three small ships made a raid on the West Indies, and thus sums up the results of his cruise:—"In this voyage we tooke and sacked four townes, seventeene frigates, and two ships, whereof eight were taken in the bay of the Honduras; the rest we sunke, burnt, and one of them we sent away with their men. And to make up the full number of twenty, the Spanyards themselves set one on fire in the bay of the Honduras, lest we should be masters of it." Sir Robert Dudley, an illegitimate son of the Queen's favourite Leicester, in another narrative describes how he with one ship of two hundred tons captured, sunk, and burnt nine Spanish ships between November 1594 and May 1595. These are but examples of many buccaneering expeditions described in this volume. One of the most interesting of the narratives is that of the expedition to the West Indies in 1595, in the course of which Sir John Hawkins and Sir Francis Drake died. The last part of the volume is taken up with expeditions to Guiana, the first written by Sir Walter Raleigh, and describing in great detail his abortive expedition in 1595; the second is addressed to Sir Walter by his friend Lawrence Keymis. Both are influenced by one motive, viz. the desire to persuade Queen Elizabeth to lose no time in undertaking the conquest and colonisation of Guiana or the new El Dorado. Keymis concludes his report with words which may be quoted as the keynote to all the expeditions and adventures of that century: "The time serveth, the like occasion seldom happeneth in many ages, the former repeated considerations doe all joyntly together importune us, nowe, or never to make our selves rich, our posteritie happie, our Prince every way stronger than our enemies, and to establish our Countrey in a state flourishing and peaceable. O let not then such an indignitie rest on us, as to deprave so notable an enterprise with alse rumors, and vaine suppositions, to sleepe in so serious a matter, and renouncing the honour, strength, wealth and soveraigntie of so famous a conquest, to leave all unto the Spaniard."

Narratives of expeditions, partly commercial and partly buccaneering, to Brazil and the River Plate occupy the first part of the eleventh volume, and these

are followed by a curious account of the first circumnavigation of the world by Sir Francis Drake, a feat which occupied just three years, viz. from November 1577 to November 1580. Farther on in the volume we have an interesting narrative of a similar feat by Thomas Cavendish, or as he was then styled, "the Worshipfull Master Thomas Candish of Trimley in the Countie of Suffolke Esquire," which, however, was accomplished in a much shorter time, viz. between July 1586 and September 1588. In estimating the difficulties and dangers of such voyages we must remember that the size of the largest ship in either expedition was only 120 tons. Cavendish had with him three ships, manned by only 123 persons of all sorts, the largest being the *Desire*, of 120 tons. The details of Drake's fleet are not given, but we are told he had five ships and barks with "164 men, gentlemen and sailers"; so it is practically certain that his largest ship was no larger than the *Desire*. In both of these expeditions they sacked as many towns of the Spaniards as they could manage, and sunk, burned, and destroyed a considerable number of ships. Farther on in the volume we have a graphic account of the last voyage of Cavendish, which, owing to bad weather and the treachery of his crew, ended disastrously, and cost Cavendish his life. In the year 1596 it was decided to attempt to open commercial relations with the Emperor of China, and so we have a curious letter in Latin from "Elizabeth by the grace of God Queene of England, France, and Ireland, the most mightie defendresse of the true and Christian faith against all that falsely professe the name of Christ, etc. To the most high and soveraigne Prince the most puissant Governour of the great Kingdome of China, the chiefest Emperour in those parts of Asia and of the Ilands adjoyning, and the great monarcke of the orientall regions of the world"; and the purport of the letter is to secure a kind reception to two adventurous London merchants, who hoped to commence a profitable trade with China. The volume concludes with three "testimonies" by Portuguese Jesuits regarding Korea, a territory which even in the last decade of the sixteenth century seems to have been considered merely a stepping-stone from Japan to China, *vide* the first testimony, which contains "a resolute determination of Quabacondono the great Monarch of all Japan, to invade and conquere China by the way of Coray, being a country divided from the Isles of Japan only by an arme of the sea about twentie leagues broad, and abounding with victuals and all other necessaries for the maintenance of the warres." The "testimonies" are unanimous in asserting that "the Chinians be weake, and the people of Japan so valeant and so feared of them" that the overthrow of the Chinese empire was inevitable, a contingency very much to be deprecated, as it "would be the ruine of all this Christianitie; neither should we have any place wherein to remaine." This volume is quite as interesting as any of its predecessors.

Grundriss der Handelsgeographie. Von Dr. MAX ECKERT, Privatdozenten der Erdkunde an der Universität Kiel. Leipzig: G. J. Goschensche Verlagshandlung, 1905. 2 vols. Pp. 229 and 517.

Dr. Eckert has divided his work, as usual in commercial geographies, into two parts, one treating of the articles of commerce and their distribution, the other of the products of the various countries of the world. He has collected a large amount of useful information, and his book will be very useful for reference. In some respects, however, it is scarcely what one expects a textbook of commercial geography to be. The earlier chapters on the *Erdkörper*, *Orientirung auf der Erdoberfläche*, *Bewegung der Erde* have nothing to do with the subject, and the chapters on physical geography, as it is here treated, are almost equally super-

fluous. On the other hand, more attention should be given to the physical factors which determine the distribution of each article of commerce, especially those of the vegetable kingdom, and the influence of man on its production. It is not always possible to decide where the natural conditions are favourable to a particular industry, or to discover why there is no production in a country which seems perfectly adapted for it, or why the product is of poor quality ; but these are questions which, we think, it should be the aim of a work of this kind to answer, and which in many cases can be answered more fully than in these pages. Very full information is given of the products of each country, their manufactures and means of transport, and a great number of statistics, which latter, though hardly in their proper place here, will be handy for consultation until they are out of date.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

The Other Side of the Lantern : An Account of a Commonplace Tour Round the World. By Sir Frederick Treves, Bart., K.C.V.O., C.B., LL.D. 8vo. Pp. xvi + 424. *Price* 12*s. net.* London : Cassell and Co., 1905.

By the Ionian Sea : Notes of a Ramble in Southern Italy. By George Gissing. 8vo. Pp. iv + 235. *Price* 5*s.* London : Chapman and Hall, Ltd., 1905.

Imperial Japan : The Country and its People. By George William Knox. 8vo. Pp. vi + 294. *Price* 7*s.* 6*d. net.* London : George Newnes, Ltd., 1905.

Landscape in History, and Other Essays. By Sir Archibald Geikie, D.C.L., F.R.S. 8vo. Pp. iv + 352. *Price* 8*s.* 6*d. net.* London : Macmillan and Co., 1905.

The Story of an Indian Upland. By F. B. Bradley-Birts, B.A., I.C.S. With an Introduction by the Hon. H. H. Risley, C.S.I., C.I.E., I.C.S. 8vo. Pp. xvi + 354. *Price* 12*s.* 6*d. net.* London : Smith, Elder and Co., 1905.

Au Siam. Journal de Voyage de M. et de Mme. Émile Jottrand. Pp. iv + 539. *Prix* 4*fr.* Paris : Plon-Nourrit et Cie., 1905.

La Picardie et Les Régions Voisines : Artois-Cambrésis-Beauvaisis. Par Albert Demangeon. 8vo. Pp. 496. *Prix* 12*fr.* Paris : Armand Colin, 1905.

Belgium and Holland, including the Grand-Duchy of Luxembourg : Handbook for Travellers. By Karl Baedeker. With 15 maps and 30 plans. 14th Edition. *Pries* 6*m.* Leipzig : Karl Baedeker, 1905.

L'Évolution de la Terre et de l'Homme. Par G. Lespagnol. 8vo. Pp. vi + 720. *Prix* 5*fr.* Paris : Ch. Delagrave, 1905.

Nærmest Sydpolen, Aaret 1900. By Carsten E. Borchgrevink. Large 8vo. Pp. 564. København : G. Boghandel, 1905.

Das Festland am Südpol, Die Expedition zum Südpolarland in den Jahren 1898-1900. Von Carsten Borchgrevink. Large 8vo. Pp. 609. Breslau : G. Schottlaender, 1905. Presented by Mr. Carsten Borchgrevink.

Also the following Reports, etc. :—

Diccionario Sipibo, Castellano - Deutsch - Sipibo. Apuntes de Gramática. Sipibo - Castellano. Von Karl von den Steinen. Pp. 128. Berlin : Dietrich Reimer, 1904. Presented by Professor Steinen.

The Kohl Collection of Maps Relating to America. By Justin Winsor. With Index by Philip Lee Phillips. Washington: Published by the Library of Congress, 1904.

The Statesman's Year-Book: Statistical and Historical Annual of the States of the World for the Year 1905. Edited by J. Scott-Keltie, LL.D., with the assistance of I. P. A. Renwick, M.A., LL.B. 42nd Annual Publication. Pp. lx + 1424. *Price* 10*s.* 6*d. net.* London: Macmillan and Co., 1905.

Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1899-1900. 3 vols. Washington, 1904.

A Statistical Account of Australia and New Zealand, 1903-1904. By T. A. Coghlan. Sydney: Government Statistician's Office, 1905.

Bolivia: Geographical Sketch, Natural Resources, Economic Conditions, etc. Edited and Compiled by the International Bureau of the American Republics. Washington, D.C., 1904.

The Andaman and Nicobar Islands: Census of India, Vol. III. By Lieut.-Col. Sir Richard Temple, Bart., C.I.E. Calcutta, 1903.

Report of the Librarian of Congress for the Fiscal Year ending June 30, 1904. Washington, 1904.

Maryland Geological Survey: Miocene. Vol. i., text; Vol. ii., plates. Baltimore: The John Hopkins Press, 1904.

The Geology of West-Central Skye, with Soay. By C. T. Clough, M.A., F.G.S. Geological Survey Memoir: expl. of Sheet 70. London: Board of Agriculture and Fisheries, 1904.

Fifth Report of the Geographic Board of Canada, 1904. Ottawa, 1905.

Geographisches Jahrbuch. Band xxvii., 1904. Von Hermann Wagner. Erste Hälfte. *Preis* 5 *mark.* Gotha: Justus Perthes, 1905.

Hydrographical and Biological Investigations in Norwegian Fijords. By O. Nordgaard. The Protist Plankton and the Diatoms in Bottom Samples, by E. Jørgensen, Bergen Museum. Bergen, 1905.

Contribuzioni di Geologia Chimica. Per Giorgio Spezia. Pp. xi.

Mythische Kosmographie der Griechen. Von Prof. Dr. E. Berger. Pp. 42. *Preis m.*1.80. Leipzig: B. G. Teubner, 1905.

Demografia Chilena, Rectificaciones a las Publicaciones Officiales. Pp. 69. Valparaiso, 1904.

Jelinek's Anleitung zur Ausführung Meteorologischer Beobachtungen nebst einer Sammlung. Von Hilfstafen. Erster Teil. Pp. xii + 128. Leipzig: Wilhelm Engelmann, 1905.

Stanley, le Roi des Explorateurs, 1840-1904. Par Joseph Joûbert. Pp. 54. Angers: Germain et Grassin, 1905.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 28th February 1905:—One-inch Map (third edition, engraved, with hills in brown or black).—Sheets 6, 10, 11, 16, 17, 18, 24, 25, 26. Price 1s. 6d. each.

Indexes, Parish—One-inch. Printed in colours and in two forms, one

showing the 1 : 2500 Scale Maps and the other the Six-inch Sheets.—Sheet 79. Price 1s. 6d.

N.B.—This sheet should have appeared in Addenda for December 1904.

Six-inch Maps (Revised) Quarter Sheets, Heliozincographed, with Contours. Price 1s. each.) *Banffshire.*—2 NW., 2 NE., 2 SE.; 3 SW.; 8 SE.; 9 NW.; 9 SW.; 15 NW.; 30 NE., 30 SW., 30 SE.

1 : 2500 Scale Maps (Revised) with Houses ruled, and with Areas. Price 3s. each. *Banffshire.*—Sheets II. 13; VIII. 1, 9, 14; XIV. 14; XX. 9, 13; XXVI. 1. *Inverness-shire.*—Sheet XII. 8.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st March 1905:—Map of Great Britain and Ireland. Scale 1 : 1,000,000 or approximately 16 miles to one inch. Published in Two Sheets. Price 5s.

Four-miles to one-inch. Printed in colours and folded in cover, or flat in sheets. Sheet 15. Price—on paper, 1s.; mounted on linen, 1s. 6d.

One-inch Map (third edition). Printed in colours and folded in cover, or flat in sheets. Annan, Sheet 6; Langholm, Sheet 11; Jedburgh, Sheet 17; Morebattle, Sheet 18; Peebles, Sheet 24; Berwick-upon-Tweed, Sheet 26; Eyemouth, Sheet 34. Price—on paper, 1s. 6d. each; mounted on linen, 2s. each.

Six-inch Maps (Revised) Quarter Sheets, Heliozincographed, with Contours. Price 1s. each. *Aberdeenshire.*—1 NW.; 16 NW., 16A SE.; 17A SW.; 24 NE., 24 SE. *Banffshire.*—6 NW.; 14 SE.; 15 SW.; 20 NW.; 25 NE., 25 SE.

1 : 2500 Scale Maps (Revised) with Houses ruled, and with Areas. Price 3s. each. *Banffshire.*—Sheets II. 9; VIII. 5, 13; XIV. 5; XXV. 4, 8, 12, 16; XXVI. 9, 13. *Elginshire.*—Sheets VIII. 4, 6, 7, 8, 10, 11, 12, 14, 16; IX. 6, 7; XIII. 8; XIV. 1, 2, 7, 15; XXIX. 8. *Inverness-shire.*—Sheet XIII. 5. *Sutherland.*—Sheets V. 4, 8, 11, 12; VI. 5, 9; VII. 11, 12, 15, 16; XVI. 4, 11; XXV. 4, 8; XXXIX. 2; LXXXV. 6, 10, 11; XCIV. 4, 8.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

ASIA.

MANCHURIA.—Map of the Country round Mukden. Scale 1 : 420,000. Map of the Country north of Tieh-Ling. Scale 1 : 420,000.

Topographical Section, General Staff, London.

These maps are issued by the War Office to illustrate the Russo-Japanese campaign in Manchuria. They have been reproduced from the Russian Staff Map of 1904. Price 2s. each Sheet.

CHINESE EMPIRE.—Constructed and drawn by W. and A. K. Johnston, Limited. Scale 1 : 3,041,000 or 48 miles to an inch. Mounted on rollers, varnished.

W. and A. K. Johnston, Limited, Edinburgh and London.

This is a large educational wall map, boldly drawn and with bright political colouring.

AFRICA.

EGYPT.—General Staff Map on Scale of 1 : 2,000,000 or about 32 miles to an inch. With enlarged inset maps of Cairo and Alexandria. 1905. Price 4s. 6d.

Topographical Section, General Staff, London.

LAGOS.—General Staff Map on Scale of 1 : 250,000 or about 4 miles to an inch. 1905. Sheets 73C, 73D, 73G. Price 1s. 6d. each sheet.
Topographical Section, General Staff, London.

NORTHERN NIGERIA.—General Staff Map on Scale of 1 : 250,000 or about 4 miles to an inch. 1905. Sheets 74A, 74B, 74C, 74D. Price 1s. 6d. each sheet.
Topographical Section, General Staff, London.

SOUTHERN NIGERIA.—General Staff Map on Scale of 1 : 250,000 or about 4 miles to an inch. 1905. Sheets 73H, 73L, 73P, 74E, 74F, 74G. Price 1s. 6d. each sheet. *Topographical Section, General Staff, London.*

SOUTH AFRICA.—Physical Map of ——. By J. G. Bartholomew, F.R.G.S. Showing orographical features. Scale 1 : 1,400,000 or 22 English miles to an inch. 1905. Mounted on rollers, varnished.
George Philip and Son, Limited, London.

This is an effective school wall map showing height of land by contour colouring. Railways are distinguished by red lines, and all towns are clearly shown in large type.

SOUTH AFRICA.—Commercial Map of ——. Prepared by W. and A. K. Johnston, Limited. Scale 1 : 1,267,000 or 20 miles to an inch. 1905. Mounted on rollers, varnished. Size 72 × 63 inches. Price £1, 7s. 6d.
W. and A. K. Johnston, Limited, Edinburgh and London.

This is a wall map with considerable detail, which renders it suitable for library or office use. It extends as far north as Bulawayo.

NEW ATLASES.

ATLAS UNIVERSEL DE GÉOGRAPHIE. Commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader. Nr. 46, Asie, feuille I. ; Asie Mineure, 1 : 5,000,000. Price 2 francs each map. *Librairie Hachette et Cie., Paris.*

ATLAS FOR CANADIAN SCHOOLS. A new series of Physical and Political Maps by J. G. Bartholomew, F.R.G.S. Size : Demy 4to. 48 Maps and Index.
Thomas Nelson and Sons, London, Edinburgh, and New York.

A new school atlas, in which special prominence is given to the Dominion of Canada and its various provinces. The other countries of the world are treated with less detail.

The following maps have been presented to the Society by Mr. Currie :—

MAP OF THE WESTERN PROVINCES OF HINDOOSTAN, the Punjab, Rajpootana, Sinde, Kabool, etc. Scale: 30 miles to the inch. Wm. H. Allan and Co., London, 1857.

MAP OF THE PROVINCES OF BENGAL AND BEHRA, with Benares and adjoining Territories. By J. B. Tassin. 4 Sheets. Calcutta, 1841.

ATLAS TO GEOLOGICAL PAPERS ON WESTERN INDIA, including Cutch, Sinde, and the SE. Coast of Arabia, to which is appended a summary of the Geology of India. Edited for the Government by H. J. Carter. 7 Maps and 21 Plates. Bombay, 1857.

CARTE GÉNÉRALE DE L'EMPIRE OTTOMAN EN EUROPE ET EN ASIE. Dressée par Henri Kiepert. Dietrich Reimer, Berlin, 1867.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE EVOLUTION OF THE MAP OF SCOTLAND.

FIRST STAGE.

By John E. Shearer, F.S.A. Scot., F.R.S.G.S.

(*With Maps.*)

Introduction.

This is one of the most interesting subjects that can be studied by the members of a Geographical Society or a Society of Antiquaries. On the Continent this matter of map-making has been considered of great importance, and attracted considerable attention. The principal work on the subject is Nordenskiöld's *Facsimile Atlas*, published at Stockholm 1889. This great book is in two volumes, published at £10, 10s. each, the first volume being the Early History of Cartography, with reproductions of the most important maps printed in the fifteenth and sixteenth centuries, and the second a history of Charts and Sailing directions.

At the British Museum old maps and atlases have received the care and attention they deserve; the large catalogue, in two volumes, is sold for £6, 6s., but in these volumes the Cartography of Scotland requires many additions to be made before it can be considered complete.

It is surprising to find how greatly this subject has been neglected in Scotland, and how little has been done towards the study of Cartography. There is no complete catalogue of the maps of Scotland, and no library has a collection of any importance, and even district or county maps (which abound with matters of local interest) have received little attention from any public body.

What could be a grander sight or give greater pleasure to an antiquary or a book-lover than to see a room full of all the marvellous and interesting ancient atlases and maps, in company with editions of Camden

and others, facsimile atlases, and early books of travel? From these would be seen the developments and improvements in map-making, the advance in printing and engraving, the beautiful bindings and the artistic designs on the maps, which would be both instructive and interesting.

The reason so little has been done, and can be done in the way of a history or list of the Cartography of Scotland, is owing to the want of a collection of old atlases or maps.

A small sum spent annually would in a few years make a good collection, but the unfortunate thing is that this was not started many years ago, when these works were more plentiful, and when old atlases were being removed from private libraries and were considered of small value.

The formation of this collection would be a fitting memorial to the memory of the men who laboured so faithfully and devotedly to make the early maps of our country, and of whose life and work so little now remains but the maps themselves.

FIRST MAPS OF SCOTLAND.

MAPS OF THE BRITISH ISLES.

STRABO ABOUT 20 B.C. PTOLEMY 150 A.D. SANTA CRUZ 1542

In the time of Homer, about 850 B.C., our island was not known to the civilised world. It may have been known earlier, but the credit of first visiting our shores is given to the Carthaginian Himilco, who mentioned our island in his writings about 500 years before the Christian era. Passing over 500 years, we find that the famous geographer, Strabo, about the beginning of the Christian era, had a map of our islands which bears little resemblance to our maps of to-day (see above).

Ptolemy of Alexandria, about 150 years after the Christian era, had an excellent map of Britain for the period, with one great mistake, representing Scotland as bent round to the east in place of going up northwards (see above).

This map of Ptolemy's, which was known to the whole civilised world, continued to be an authority till about 1500 A.D., and did not show Scotland as an island.

The honour of first bringing out maps which corrected the mistake of Ptolemy in having Scotland bending eastward falls to a German named Joannes Ruysch, who had his map of the world printed at Rome in 1508. In this map Scotland is not shown as an island. It is known

he was a sailor, and sailed to different parts of the world. The following extract from Nordenskiöld's *Facsimile Atlas* is very interesting:—

"The map of Ruysch is the first map published in print which, following a correction made in the portolonos since the beginning of the fourteenth century, leaves out that excessive projection towards the east which characterises Ptolemy's map of the northern part of Scotland.

"Ruysch deserves to be placed in the first rank among the reformers of cartography. His map is not a copy of the map of the world by Ptolemy, nor a learned masterpiece composed at the writing-table, but a revision of the old maps of the world on a scientific basis. Ruysch had great personal experience and geographical learning."

Scotland shown as an Island, 1528.

Very soon after the beginning of the sixteenth century, it must have been thought on the Continent that Scotland was surrounded by water, as in the Atlases by Benedetto Bordone, published at Venice in 1528, 1533, and 1534, there is a map in each book which shows Scotland as an island.

The edition of 1528 is a beautifully printed volume of 74 pages. Ptolemy's maps of the British Isles, Europe, and one of the World are given, showing Scotland in the regular bent east peninsular form (see map, p. 294).

There are many quaint and bold woodcut maps printed along with the letterpress. One of these small maps, as shown on page 292, gives "Scocia" divided from England by water.

The first Harleian Manuscript 1535 Map of the Known World, size about eight feet by four feet, now in the British Museum, is attributed to Pierre Desceliers of the Dieppe School of French Cartographers. The Earl of Crawford and Balcarres, who at one time owned these maps, had reproductions made privately a few years ago at great cost, and the work was named *Bibliotheca Lindesiana, Collections and Notes.* These reproductions can be seen in the Mitchell Library, Glasgow. The famous Map of the World by the Spanish geographer Santa Cruz in 1542 (see opposite), and the map of 1544 by Sebastian Cabot, who came from Venice, and lived successively in England and Spain, like the 1535 map just mentioned (see map, p. 296), both show Scotland as an island.

If we consider what was intended for Scotland on English maps of the thirteenth, fourteenth, and fifteenth centuries, we find that in England, Scotland, or a large part of Scotland, is always shown as an island, and this information travelling over to Italy, France, and Spain led Bordone, Desceliers, and Santa Cruz away from the old work of Ptolemy, and into the mistake of making Scotland an island.

The second Map of the World drawn by Pierre Desceliers, however, dated 1546 (six years after Alexander Lyndsay's voyage round Scotland with James v.), shows Scotland in its true relation to England, and not surrounded by water (see map, p. 298).

Very soon after the middle of the sixteenth century it must have been known to the famous geographer and map publisher, Ortelius, in

the Netherlands, that Scotland was not an island, because in 1570 he brought out his atlas (which would be some time in preparation) containing a map of the British Isles and one of Scotland. These maps do not show Scotland as an island, and they resemble somewhat in form our maps of the present day.

The map of Ortelius proves that shortly after the middle of the sixteenth century an atlas was published which gave a map of Scotland,

England with Scotland as an Island. By Bordone. Venice, 1528.

and presented a fairly accurate conception of this country. Ortelius seems to have obtained assistance from Humphrey Lloyd, a native of Britain. Camden mentions in his famous work that Abraham Ortelius "did very earnestly solicit him" to undertake the task of writing the *Britannia*, and that he assisted Ortelius.

The credit of first publishing a map showing something like the true shape of Scotland has been recently given to Mercator, whose atlas came out about twenty years after that of Ortelius. On comparing these two early printed maps Mercator's is found to resemble in many points that of Ortelius, with improvements.

The Berlin Geographical Society in 1891 published a large folio of "re-found" unpublished maps by Mercator, and among these drawings Great Britain is given on eight sheets and is dated 1564. The Scotland, on four of these sheets, bears a very striking resemblance to the smaller map issued by Ortelius in 1570; but taking all the circumstances into consideration there are good reasons for supposing that Ortelius collected in England the information which he carried over to the Continent, and that these improvements, which are to be seen in his own publication of 1570, and in the hand-drawn map by Mercator of 1564, were gathered together by Ortelius.

It is a mistake to think that foreigners sketched and made our maps of Scotland. They no doubt printed and published our maps for a long time down to the seventeenth century; but with the exception of Ptolemy, about 150 A.D., the gathering of the information and compiling of our maps were done by natives of our land, who sometimes gave the information away, but, fortunately, sometimes published their own maps.

Alexander Lyndsay, the pilot of James v., Timothy Pont, Robert Gordon of Straloch, his son, Rev. James Gordon of Rothiemay, and others, along with the surveyors of the old large county maps, were the men who did the work of building up and improving the early maps of Scotland.

If it had not been for Sir John Scot of Scotstarvet, the maps of T. Pont would not have been taken care of and published.

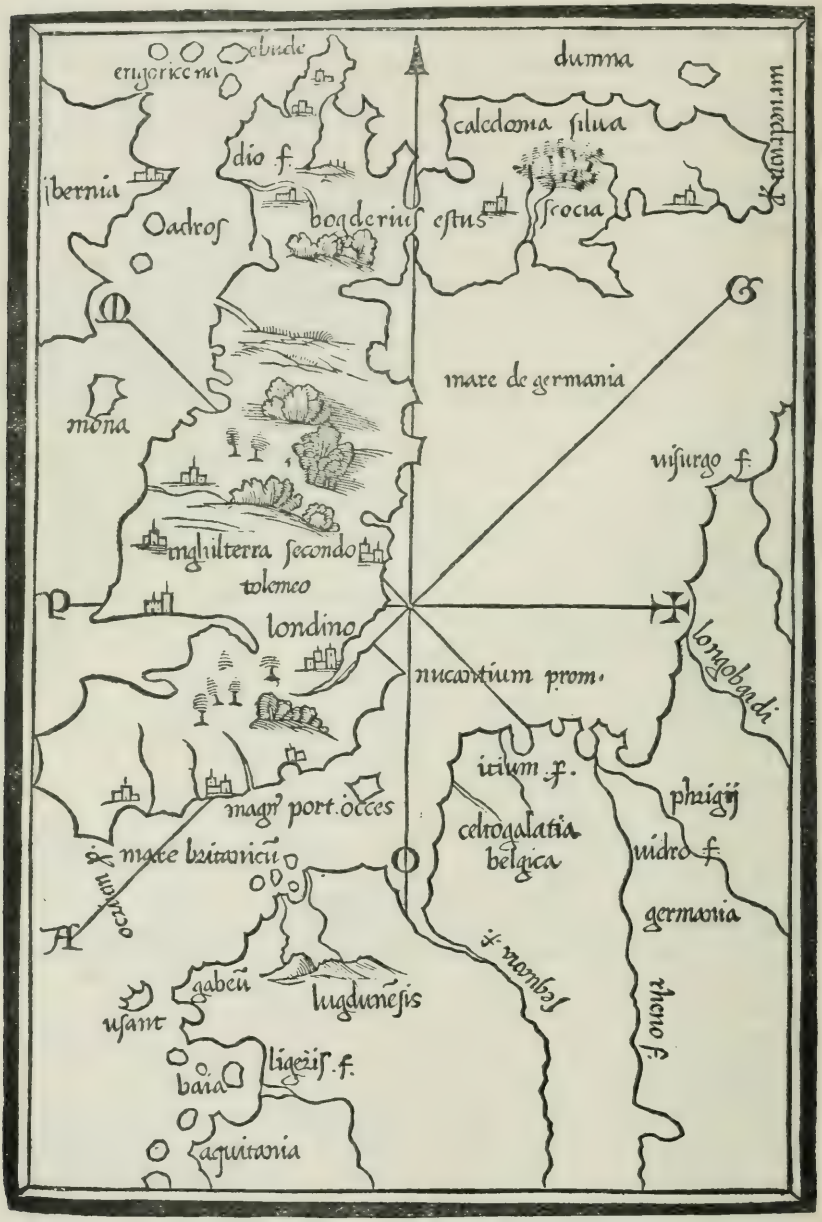
Alexander Lyndsay, the pilot with James v. on his voyage round Scotland in 1540, did a great service to his country and to map-makers by surveying and compiling a log-book of the Scottish coast-line and islands. Leaving out Ortelius, who published Scotland in his atlas in 1570, many maps from 1540 down to that of Gordon in 1653, and afterwards that of Jansen's in 1659, have several portions of their coast-lines resembling the Lyndsay D'Arfeville map of 1540-83.

The small island, Rona, 45 miles NNE. of the Butt of Lewis, has been placed by Ortelius, 1570, almost in line with the top of Lewis. (This may have been done by the engraver to give space for his finely designed title of this map.) The map of the voyage of James v., which came out and was printed in 1583, has the island nearly in its correct place, about 40 miles to the north, and it is curious that three map-makers who came after (Mercator, 1595; Speed, 1610; and Jansen, 1659), all copied the 1540-83 map for their coast-line, and that of Ortelius, 1570, for the position of the Rona island and the internal arrangement of the country.

On the Ortelius map the northern coast-line from Cape Wrath to John-o'-Groats rises gradually from west to east (this is seen as well on Mercator's 1564 hand-drawn map). The Lyndsay-D'Arfeville 1540-83 map and the printed Mercator of 1595 have it almost level, and there is also added on the 1595 map a long promontory like a crow's beak on the north-east of Lewis, and these peculiarities were repeated down to the time of Jansen, 1659.

The hand-drawn Mercator of 1564 and the printed Ortelius of 1570

read and have to be looked at from the right side, but the Mercator



Ptolemy's Map of Britain as printed in Bordone's Atlas. Venice, 1528.

from the atlas of 1595 has the printing from left to right in the usual way. The printed Mercator's map is a great advance on the hand-

drawn map, and has improvements taken from the Lyndsay-Arfeville map of 1540-83.

As we have now reached a period when Scotland is fairly well shown on maps, we will turn back to the beginning of map-making, and see how maps grew in size and improved in appearance, and how the art of map-making started in the East and travelling from one country to another by the Mediterranean, took a strong hold on Italy, Germany, France, Holland, and then on our own country.

British Isles, by Strabo, about 20 B.C., p. 290.

Strabo was born about 64 B.C. in Asia, near the Black Sea. He was a student, writer, and traveller, and was living at Corinth in 29 B.C., ascended the Nile 24 B.C., settled in Rome 14 A.D., and is believed to have died after 21 A.D.

Strabo wrote a great historical work, very little of which now remains, but his *Geographia*, from which this sketch was taken, was a work in seventeen books. Editions of this work have been published on the Continent from 1472 onwards, and in 1854-57 an edition was printed in English in Bohn's Library, in three vols.

Map of Britain, by Claudius Ptolemy, 150 A.D., p. 290.

The compiler of this map was born in Egypt, and lived in Alexandria from 139 to 161 A.D. He did much to correct the work of former geographers, and was famous for his knowledge of astronomy.

He constructed a series of twenty-six maps, with a general map of the world—a work he could never have carried out if it had not been for the earlier labours of Marinus of Tyre. This map was first printed at Rome in a Latin edition of the atlas in 1478, and Scotland is represented as bent fully round to the east.

From the appearance of Ptolemy's map it is very likely he got information that had been gathered by the Romans when in this country.

In this map Scotland is not shown as an island, as was done in maps printed hundreds of years after in France and Spain.

This map had a very long life, and was not superseded by an improved map for more than a thousand years.

Even after that date publishers of atlases in the sixteenth, seventeenth, and eighteenth centuries had so much reverence for Ptolemy's map that it was printed and bound up in their atlases alongside of newer and more correct maps of Scotland.

It is the first map in the volume of Blaeu's *Atlas for Scotland*, and an edition of the atlas was published at Amsterdam as late as 1730.

It was only after the time of James V.'s voyage round Scotland, in 1540, that more correct ideas about the coast-line of Scotland were entertained.

The next three maps show what was done in the way of map-making in England in the thirteenth, fourteenth, and fifteenth centuries, when English people believed Scotland, or a large portion of Scotland from the River Forth northward, to be an island, an idea that could never have been held by native Scots.

Britannia, by Matthew Paris, about 1235.

The original of this map is believed to be by his own hand, and was made about 1235. Matthew Paris, the best Latin chronicler of the thirteenth century, was born in England about 1200 and died 1259.

In the neighbourhood of Stirling the following matters are of interest. The Firths of Forth and Clyde are shown to be joined, and

Coast-line of the British Isles, attributed to Pierre Desceliers, 1535.

from Stirling northward Scotland is represented as an island, Stirling, spelled Est'velin, being marked on the island on the north side of the Forth, and on the opposite or south side, where the town should stand, the word "Pons" is printed. This is the first map showing Stirling Bridge.

The country north of the Forth is named "Albania," or "Scocia ultramarina," *i.e.* "beyond the friths." The names Fife, Dunfermline, Lothian, Glasgow, and Edinburgh are given. The most northerly Roman wall (Graham's Dyke) is named "Wall deviding the Scots and Picts of old," and the wall further south is named "Wall separating the Angles and Picts of old."

Scotland before 1314.

(Northern half of a map of England and Scotland.)

The author or date of this map has never been ascertained. Ancient and modern writers agree that it was drawn about 1314, or probably earlier.

The original drawing of this map was before the Society of Antiquaries of London in 1769, and it was preserved, very carefully engraved, and published by Gough in his book, *British Topography*, in 1780, and a little later it passed into the Bodleian Library.

This map has been reproduced by the Ordnance Survey in the National Manuscripts of Scotland, and, with a description, will be found in Hume Brown's *Early Travellers in Scotland*.

This map shows finer drawing and more detail than on the one last mentioned by Matthew Paris of 1235. North of Stirling is still represented as an island, but Stirling is now shown on the proper side of the Forth. Stirling and Dumbarton are shown with castles; Edinburgh has a castle and church with spire; Cambuskenneth (left out of a modern edition), Dunblane, Glasgow, and St. Andrews have all churches with spires.

This is the first map I have seen recording wonders in our large lochs, but the example has been followed in later maps.

Here we learn about Loch Tay:—"In isto lacu tria mirabilia, insula natans, pisces sine intestinis, fretum sine vento."

Carlisle to Lindores, 1461.

(Reign of Edward IV.)

This is a portion of a most interesting and curious map, which contains notes which are not complimentary to Scotland, and the words "Wilde Scottz," are placed at Mar, Athole, and many other districts. "The original MS. is in Harding's chronicle in the Bodleian Library. It is written in large letters on parchment, bound in silken or velvet cover, adorned with brass bosses, titled Chronicles of Inglande, in Inglyshe, written ballet wise on parchment." Gough, who describes and gives illustrations of these maps in his *British Topography*, says this seems to have been the author's presentation copy to Edward IV.

Harding was born 1378, and died 1465.

Scotia Tabula, by Abraham Ortelius, published Antwerp, 1570.

Scotland, from Bishop Leslie's History, published Rome, 1578.

These two maps are the first printed maps of Scotland, and the map by Ortelius may be taken as the starting point in map-making.

Abraham Ortelius was born at Antwerp in 1527, and died 1598. He travelled through England, Germany, France, and Italy, hunting up maps and information. Ortelius got the maps together and published

Scotland not an Island.

Coast-line of British Isles. By Pierre Desceliers, 1546.

the first atlas. Almost all his maps are copies, and he mentions where the information was obtained. Ortelius was a dealer, collector, and intelligent publisher, but did not engrave maps or execute surveys. In his Atlas is given a valuable list of all the maps he had been able to accumulate, and in it is to be found the work by Humphrey Lhuyd (see Nordenskiöld's *Facsimile Atlas.*) This Lhuyd, or Lloyd was a

physician at Denbridge, an antiquary, traveller, and the author of the first modern map of England.

The first edition of his great atlas, Theatrum Orbis Terrarum, was published 1570, and the following are a few of the editions which followed—1573, 1579, 1584, 1595, 1606. Editions appeared with the text in many languages, and, after 1600, in English. This atlas had a great sale, and through this work the neighbouring country, Holland, became for a time the centre for map-publishing.

Where Ortelius picked up all the information to make this improved map of Scotland it is difficult to say, but that the information came directly or indirectly from Scotland there can be no doubt. There is one thing we have very good ground for believing, and that is that a compiler of an atlas of the world, who lived on the Continent, would have his time too fully occupied to have the necessary leisure to visit Scotland, and even if he had the time in these early days it would have been a laborious and difficult task.

The information given on this map is curious:—"Loch Lomond is subject to great storms, and the fish in it are without fins," and the six islands named on the loch have only a very slight resemblance to the modern names—"Horryn," "Morayn" (probably now Inch Murren), "Brekwell," "Wag" (probably Fad), "Roody," "Brake." These have been carefully copied by Mercator on one of his maps published twenty years after.

Scotland, published 1578.

The map in Leslie's book is small in size, very rare, not nearly so good as that of Ortelius, and of little importance as a map. It is to be found in a few copies of his *History of Scotland*, which was published in Latin at Rome in 1578. The book was named *De Origine Moribus et Rebus Gestis Scotorum*.

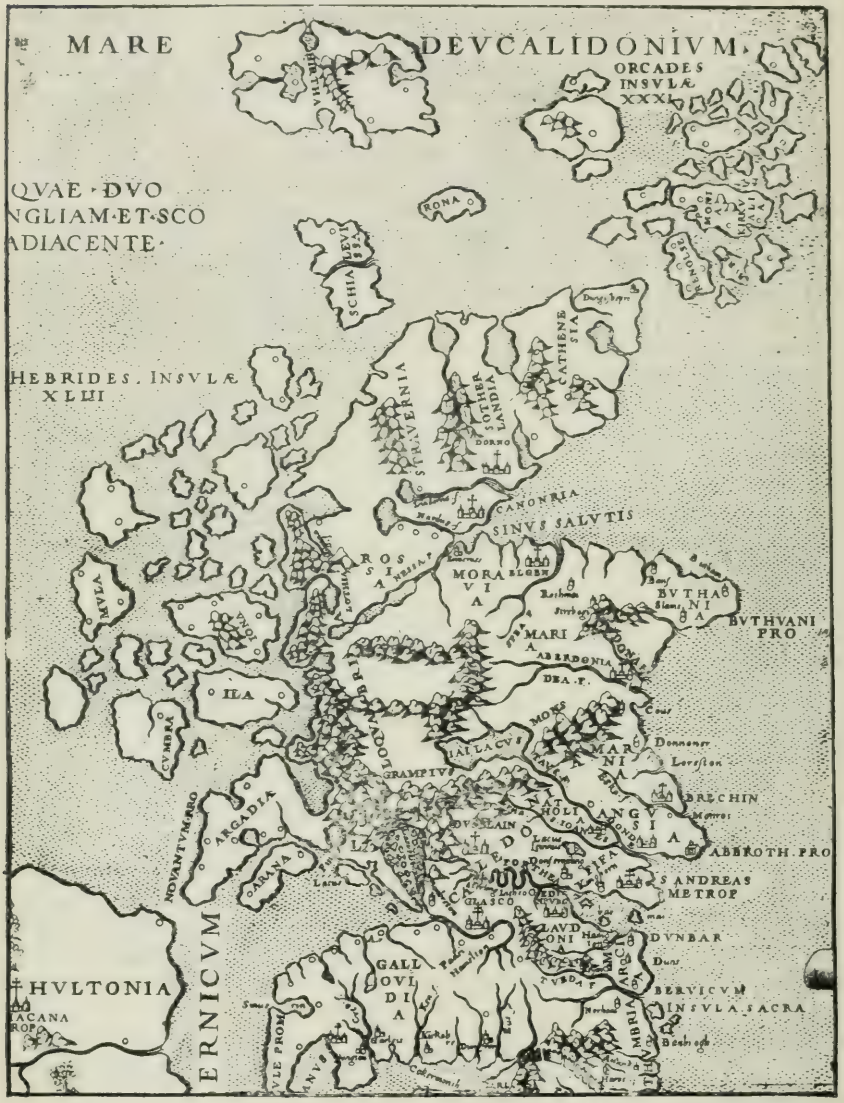
This map has been mentioned as if it was the work of Bishop Leslie, but on comparing with the maps of Jacopo Gastaldi, who had his atlases and maps of Great Britain printed at Rome from 1546 by Antonio Leferi, the first printer (after Ptolemy's Britain of 1478) of maps of this country, we find, as might be expected, that Leslie got his map of Scotland from one of Britain by this famous map-maker in Rome, where his book was being printed. At the Scott of Largs sale, a copy of the first printed (after Ptolemy) and very rare map of the British Isles by Gastaldi, dated Rome 1546, size 30 × 22 inches, sold for £26 (see map, p. 300).

John Leslie was born in 1527, became Bishop of Ross, and was a friend and adviser of Queen Mary, with the result that he was compelled to go to the Continent, where he died 1596.

Scotland, by Nicolay D'Arfeville and Alexander Lyndsay, Paris, 1583.

This map is from a very rare little book published in French, at Paris, in 1583. The work is the log-book of the voyage of James v. round his kingdom of Scotland in 1540.

The book in the original is a small quarto of 37 double pages,



Map of Scotland, printed 1556 from a Map named
BRITANNIA · INSULA · QUAE · DUO ·
REGNA · CONTINENT · ANGLIAM · ET · SCO-
TIAM · CUM · HIBERNIA · ADIACENTE ·
By Jacopo Gastaldi. Published by Antonio Leferi at Rome from 1546.
Map measures 20 × 14 inches.

and the reprint is a small octavo; copies of the first edition have been

sold at sales from £47 to £140, and at the Scott of Largs sale a copy was sold for £22.

Alexander Lyndsay, called "excellent Scotch pilot," was the navigator who gathered the information which helped most map-makers from 1540.

This map was brought out by Nicolay D'Arfeville, cosmographer to the King of France in 1583, forty-three years after the voyage; it is well to mention that this Frenchman was not with James V. on his voyage, and that the map was compiled from information supplied by the Scotch navigator.

John Adair, in 1688, at Edinburgh, engraved and republished this map.

Gough mentions that Nicolay accompanied the French fleet of sixteen galleys, sent by order of Henry II. of France to besiege the castle of St. Andrews, held by Beaton's murderers.

TRISTAN D'ACUNHA.

THE three islets known as the Tristan d'Acunha Group lie in the South Atlantic Ocean due south of the Island of Ascension, and, roughly speaking, half-way between Monte Video in South America and the Cape of Good Hope. The volcanic peak in the principal island, which gives its name to the group, is in lat. 37° 5′ 50″, long. 12° 16′ 40″, and it stands 7640 feet above the level of the sea. In his address to the Geographical Section of the British Association in Edinburgh in 1892, the present President of the Royal Scottish Geographical Society pointed out that these islands, like those of St. Paul's and Ascension, spring from the back of the Great Dolphin ridge, and were the result of volcanic action, accompanying crustal movements in the oceanic trough. They emerge from obscurity into history in the beginning of the sixteenth century, when the Portuguese led the van in oceanic exploration and discovery. The Portuguese Tristan d'Acunha who first discovered them, however, did nothing but give his name to the largest island of the group. They were known to the Dutch in 1643. In 1767, however, the French, under the command of M. d'Etchevery, landed and explored all three islands; and he gave to the one on the west of the main island the very appropriate name of "Inaccessible," while to the smallest of the group, *i.e.* the one on the south, he gave the very inappropriate name of "Nightingale." All these islands remained uninhabited till the year 1790, when an enterprising American, Captain Patten, landed with a few men and collected seal-skins, which he disposed of profitably in China. It was not till the year 1810 that a serious attempt to colonise the island was made. In that year three other Americans landed, and

one of them, Jonathan Lambert by name, declared himself sovereign proprietor, and with his companions began to clear the land and till the soil, as well as prosecuting their main business of killing seals for their skins. Jonathan, however, soon tired of his throne, and taking with him one half of his subjects he returned to America, leaving the other half, viz. Thomas Currie, alone on the island till 1814, when a Spaniard, Camella by name, joined him.

After the fateful battle of Waterloo in 1815 the captive Emperor Napoleon was deported to St. Helena, and the British Government deemed it necessary to take every possible precaution against his rescue.

Commodore John Pepper, I.N.

Amongst other measures for this purpose they decided on the annexation of the Tristan d'Acunha group, and this was accomplished on the 14th August 1816. The first commandant, Lieutenant Rich, R.N., remained on the island only three months, when he gave place to a captain of dragoons, Josiah Cloete by name, who held office for a year. Captain Cloete brought with him about one hundred men and seventeen women, with some horses, pigs, cattle, and poultry. By the end of a year the British Government had recovered from its nervous fit of anxiety as to the possibility of an attempted rescue of Napoleon from Tristan d'Acunha, and it was decided to withdraw the military from the island. So in November 1817 the force returned to the Cape of Good Hope, leaving behind them three men, viz. Corporal Glass and

two privates, with Glass's wife and two children. These six persons may be considered the original settlers of Tristan d'Acunha, and their descendants are still to be found in the island. Corporal Glass remained governor of the island till his death in 1853, and seems to have exercised his authority with discretion and humanity. From time to time the little community was reinforced by victims of shipwreck and by volunteers, so that at the time of Glass's death they numbered over eighty. Before Glass died the Society for the Propagation of the Gospel had sent a clergyman, the Rev. W. F. Taylor, to supervise the educa-

Ann Pepper.

tional and spiritual needs of the colonists, and on Glass's death Mr. Taylor was recognised as governor. Mr. Taylor, however, got tired of the place, and left it in 1857, when he was succeeded by Peter William Green, a mariner, who had been shipwrecked on the island. He lived to the extreme age of ninety-seven. "As a preserver of life from shipwreck Governor Green's record stands almost unique. The exact number of people of all nationalities whom he has assisted, in fact taken the lead, in rescuing from destruction, amounts to hundreds."

In the early days of the colony shipwrecks on one or other of the islands were not uncommon, and must have been a source of considerable profit to the colonists. With regard to one of them, viz. that of the

Blenden Hall, which was wrecked off Inaccessible Island in July 1821, there is now in existence, in the possession of one of the descendants of one of the shipwrecked passengers, a manuscript giving a vivid description of the disaster and the subsequent misfortunes of the survivors. Among the passengers in the ill-fated *Blenden Hall* was a Lieutenant in the Indian Navy—a scion of a good old English family in Kent. The Peppers of Tenterden can trace their family in Kent as far back as 1450, that is to say, to the times of the Wars of the Roses, or half a century before the discovery of Tristan d'Acunha. Other branches of the family appear in Lincolnshire, and in County Meath in Ireland, about 1660; and they may also be connected with Colonel Pepper of Pepper's Horse, who did good service under Cromwell. The member of the family on board the *Blenden Hall* was John Pepper, who at Dover—shortly before he went on board—married Ann, the daughter of Captain Evans, H.E.I.C.S. His age was only twenty-seven, but he had already seen service in the Far East, and had taken part in the taking of Java. His wife was not quite twenty-one, and to judge from the miniature of her still in existence she must have been an exceptionally beautiful girl. The Lieutenant was on his way to join his ship at Bombay, but the *Blenden Hall*, partly owing to fogs and partly to bad weather, was allowed to get out of her proper course, and was wrecked on Inaccessible Island. This island, as we learn from its description in *The Cruise of the Challenger*, which contains much the best account of the Tristan d'Acunha group which we have yet seen, and to which we are greatly indebted for much of the foregoing remarks, "next in size to Tristan, and the most westerly of the group, receives its name from its appearance; and certainly this name seems most applicable when the island is viewed from a distance of two or three miles. A nearer approach, however, discloses the fact that beaches exist, here and there, at the foot of the almost perpendicular cliffs, all around the island, and on the north-east and north-west sides these beaches are occasionally so wide as to afford space for building purposes, or pitching tents; and from two points where the cliffs are somewhat broken it is possible, by the aid of the Tussock Grass, which grows on every available spot, to climb to the undulating table top of the island. Inaccessible Island is quadrilateral in shape, the sides being nearly equal, each about two miles in length, and the angles pointing in the direction of the cardinal points of the compass. Its highest point, on the west side, is 1840 feet above the level of the sea. . . . The north-west coast has no rocks off it above water, but there are rocky shelving points projecting from the beach, which extends the whole length of this side of the island."

It was on one of the reefs to the north-west of the island that the *Blenden Hall* struck and soon became a total wreck. It was with the utmost difficulty that the passengers and crew, with the exception of two men, were got to land, where they at first supposed and hoped they were on Tristan d'Acunha. Several of the sailors behaved very badly, becoming hopelessly intoxicated. The Lieutenant, in language which to us now seems stiff and stilted, but which is quite in accordance with the style in common use in the early part of last century, says: "Night

approaching we retired to the rushes about fifty yards' distance from where we landed for the night, in the distressed state we were in, some of the Passengers being without any other Clothing than a Shirt. Some Spirits which had drifted on shore gave an Opportunity to those who first landed to get intoxicated, of which they availed themselves, and added to the horrible scene around us. The Island affording no shelter we were exposed to the Rain, which fell very heavy during the night, without sleeping, and were frequently annoyed by such of the Crew as were drunk, together with the noise of the Chain Cable and Anchors striking against the rocks. At Daylight, about 6 A.M., all was confusion, the men shaking off the yoke of subordination, and taking upon themselves an equality with the passengers, which they did not hesitate to avow in terms accompanied by the most opprobrious Language." With daylight, however, returned hope and the necessity for action, and various parties were despatched to explore the island and to select places where it was possible to rig up tents, and, what was necessary more than anything else, to find something in the way of food. But all they could find in that way was some roots of wild celery, so the Lieutenant goes on: "Our Food this day consisted of Penguins and Raw Beef which we had picked up, being unable to make a Fire for want of materials, and the dampness excluded the Possibility of obtaining one by friction. Nothing but extreme hunger Could have induced us to partake of food in a State revolting to the feelings of Human beings." During the course of the next day a number of very useful articles floated on shore from the wreck, including a box of instruments, which fortunately contained a flint and steel, by means of which they managed to light a fire, whereupon the Lieutenant says: "Miserably as we were off the warmth of the Fire afforded us much comfort, particularly the Ladies, who had suffered extremely from Hunger, Wet and Cold—in fact several of the Passengers were so much exhausted that apparently they were near expiring." After this they began to vary their diet with the brains, head and tongue of female sea-elephants and a soup made of penguins and wild celery, in which they "found considerable nourishment, notwithstanding it was very mawkish." The weather, however, now improved, and with it the health and the spirits of the company, who set about diligently to explore the island and to rig up boats with a view to making for Tristan d'Acunha. Something very like mutiny, however, soon appeared to add to their troubles. "Fourteen of the Seamen, who had united and separated, requested one of the Kettles which the Captain and Passengers acceded to by granting the smallest of the two we had, which did not hold more than the proportion their number entitled them to—but hearing dissatisfaction existed among the others, he called them together and explained his motives for complying with their demand, upon which they unanimously refused to assist in the Ordinary employments assigned them by the Captain, at the same time offering to do everything for him and his Son, leaving the Passengers to provide themselves. This was rejected, and the Line of Conduct they pursued called forth a strong remonstrance from the Second Officer, who had determined to remain

by his Captain and Passengers in their feeble state, which had no effect. Consequently the Passengers were obliged to act entirely for themselves, although they offered from £8 to £10 per month to assist in getting food, which was not accepted—observing that the Island Inaccessible carried no Passengers and that all were on one footing." The next misfortune to befall the company was the disappearance of the penguins and female sea-elephants, "which left us with the forlorn prospect of being destitute of Food, when the store we had accumulated should be expended until the season of their return—the impression on our minds at the approaching scarcity began to be visible in every countenance. We also found great loss from want of wild celery, which could not be had without great difficulty, having to ascend the Hill on the brink of Precipices to the imminent danger of our Lives to gather the few remaining Roots." But the absence of the female sea-elephants was compensated for by the appearance of plenty male ones, and of petrels; but unfortunately they stayed on the island only eight or ten days. In the meantime the passengers had constructed four boats, "which did very well alongshore but could not fully be depended on to risk the Voyage in Contemplation as the Tools used in their construction were a Hand Saw, an Old Chisel and a Bolt as a substitute for a Hammer, with a Post Hinge rubbed to an Edge instead of an Axe." At last, taking the advantage of a fine day one boat did succeed in getting to Tristan d'Acunha, where its crew were warmly received by Corporal or Governor Glass, who next day brought two boats to Inaccessible Island with milk and provisions. On the 11th November the Lieutenant and his young wife were safely landed at Tristan d'Acunha, "where we were gratified beyond the Power of expression to see something approaching in appearance to Domestic Comfort," which comfort was dispensed by the Corporal at the moderate cost of 2s. a day. But they were now safe, and the Lieutenant remarks, "The wide difference we now experienced compared with the Conduct of the Crew occasioned feelings of Disgust and enhanced the Value of favours rendered us, nor is it possible to convey a just idea or conception of what passed in our Breasts on seeing the Boat with the last of our unfortunate Companions on the shore of Tristan d'Acunha. Our feelings choked utterance, and it was only with tears of Mutual Sympathy we embraced each other." On the 10th January 1822 the *Nerina*, bound for the Cape of Good Hope, hove in sight, and the captain promptly undertook to take the whole party on board, and they were all safely landed at the Cape on the 21st January. From the Cape the Lieutenant made his way to India, where he was appointed first assistant to the master attendant at Bombay. On his promotion to the rank of commodore he joined the *Amherst*, and took a prominent part in the suppression of piracy on the Arabian coast. There he blockaded the pirate fortress of Aboothobee, and compelled the surrender not only of their prizes but of their whole fleet and plunder, valued at many lacs of rupees. For three years he was commodore at Surat, after which he went to China as commodore of the squadron there. On the conclusion of the Chinese War he returned to Bombay, where he became acting storekeeper, and ultimately

acting commander-in-chief. He died at Poona in August 1848. The memory of the incident of the shipwreck is perpetuated in the family by the name Nerina being given to several of the female descendants of the beautiful Ann Pepper even to the present day.

Nightingale Island, which seems never to have been inhabited, is just one mile in length and three-quarters of a mile wide. The seals which were once abundant are now comparatively scarce, the result of reckless and indiscriminate slaughter. Penguins are as numerous as ever. There is a large amount of guano on this island, but an attempt to utilise it for the purposes of commerce fell through. If the attempt to make a fortune out of the guano in Nightingale Island has hitherto been a failure, not so has the attempt to discover treasure in the shape of bullion hidden on the island by pirates of former days. In the April number of the *Nautical Magazine* of 1901 there is a curious story to this effect. It appears that in October 1900, the yacht *Kwasimel* started from New Orleans to an island on the African coast, having on board a search party headed by an old sea-captain who had been a pirate and knew of a treasure buried by pirates on the island half a century before. They missed the bulk of the treasure, but found another chest the bullion in which was sufficient to make the venture profitable. One of the successful party announced that he knew of a still greater fortune buried on Nightingale Island, but he was not aware of the exact spot where it is hidden. In the same article we are told of a lawsuit going on in America, where a Mr. Summers sued a Captain Henderson for £17,500, the half of a treasure known to have been found on an island near Tristan d'Acunha. Apparently, then, there are possibilities of considerable gain to adventurers in the shape of treasure-hunters in these islands.

One of the most noteworthy of all the incidents in the history of Tristan d'Acunha was the visit of *H.M.S. Galatea* in August 1867 with the Duke of Edinburgh on board—a visit still commemorated in the island by the name of Edinburgh being applied to the principal settlement. Probably it was on this occasion that the islanders started their own national anthem, of which the following is the first verse:—

"Wrapt in the solemn sound
Of ocean all around
Upon our rugged wind-swept island home;
Far from the busy world
The Atlantic waves are hurl'd
Against our rocky shore in mist and foam."

Some twenty-five or thirty years ago, when the whaling industry was profitable, the islanders received many visits from passing ships. Of late years, however, they have been more isolated from the world, but they are still visited with more or less regularity by government ships. From a Blue-Book published in 1903, we gather that another attempt was made in 1902 by the Society for the Propagation of the Gospel in Foreign Parts to induce a married clergyman to go and settle in the island; but after thinking over it for three or four weeks the missionary

in question changed his mind and refused to go. The latest report regarding the island is to be found in the Blue-Book referred to, and it indicates that the community has not been nearly so prosperous of late years. The population consists of seventeen families and seventy-six persons, of whom thirty-two are children. The oldest man, "Sammy Swain," is only forty-six, while there are eight women over fifty-five—a state of matters explained by a disastrous boat accident in 1885, in which nearly all the adult male inhabitants were drowned. All the inhabitants except four were born in the island. "The majority of the islanders, though rather sunburnt and weather-beaten, are practically white. . . . The women are decidedly finer specimens than the men. Several are quite tall, and they all have well-developed figures. Their features are regular, pleasing, and of somewhat Semitic type. They appeared rather more intelligent than the men. The children are clean, fat, healthy, and well cared for, and surprisingly well clad. There is no definite sign of any mental or physical deterioration arising from the system of intermarriage." The island is reported to be healthy, except for a mild type of asthma which is successfully treated by inhaling saltpetre. There has been no form of government on the island since the death of Green, as "the men were curiously averse to any individual being considered to have more influence than the rest." There is no crime, and the population are much more anxious about education than about religion, a state of matters which may possibly be accounted for by the fact that when there was a missionary on the island, absentees from religious services were fined. Sacks of tracts are often sent to the island, some of which were found lying untouched under the shelter of a cliff. It appears that the islanders have an ample supply of potatoes, milk, beef, mutton and poultry, but for flour and luxuries they depend on passing ships, and thus are often reduced to great straits. Rats are the curse of the island, preventing grain from growing and eating the grass used for thatching. The colony owns some 600 head of cattle, 700 sheep, and 100 donkeys, and they have abundance of fish. The water-supply from the cliffs is excellent. The Blue-Book report contains the ominous and suggestive remark, "Should there be no wrecks, the islanders will shortly be hard up for a good many things." But wrecks and the visits of passing ships are precarious resources on which to depend. Moreover, of late there has been a proposal to discontinue the periodical visits of men-of-war from the Cape Squadron, and the minds of the islanders have naturally been much perturbed; so much so that many of them have expressed a desire to be taken off to the Cape. Some are willing to go unconditionally; the majority, however, were prepared to go only if they could realise their live stock. Two women, the one aged seventy-four and the other aged seventy-two, expressed no desire to leave the island. It is suggested that if a schoolmaster were sent out, or some arrangement made for the education of the children, the colonists would not be so ready to leave. It would certainly be a matter of regret if Tristan d'Acunha again became uninhabited. "The island may in the future have a value should a large carrying trade be established between South America and the Cape, as an intermediate station for wireless telegraphy.

. . This, and the occasional assistance given to shipwrecked people, seem to be the only reasons that can be imagined for occupying the island." So writes the officer in command of the *Thrush* in the report from which we have quoted so freely, and in this he merely reiterates the views expressed by the writer of the *Cruise of the Challenger*, who, however, added an useful and feasible suggestion, viz. that a schoolmaster or missionary should be sent to the island with the position of Governor. If this were done, it is most likely that no more would be heard of the proposal to abandon the island.

ON GEOGRAPHICAL METHOD.

In our January issue we published a short article on the value of geography, which originated in a press correspondence on the subject. It may be well to follow up this article by a note on methods of teaching and studying geography. There are signs on all sides of a renewed interest in the subject, a renewed pushing of its claims, as exemplified, for instance, in the recent formation of a committee to promote the establishment of a Chair in Geography in Edinburgh University. All this is good; but it must be remembered that it is not sufficient that geography should be increasingly taught and studied, it must be taught and studied according to the best methods available, it must be instinct with the spirit and the teachings of modern science. It may be, as has been said, that we require more and better maps, but we want more than that, we want an increasing power to use, to understand our maps. In brief, we want above all improvements of methods, fuller utilisation of the best available methods.

In the previous article stress was laid upon the value of geography as a discipline in the methods and results of modern science; but it should be noted that in the past geography has largely failed to become this on account of faulty methods of teaching. Indeed, like the twin subject of history, geography in the past has often degenerated into the worst type of "book-work." There can be but little doubt that if it had been taught aright the attempt to dethrone it from its rightful place in favour of "nature-study" would not have been made. Let us consider for a moment wherein consists the supreme value of such a subject as biology. Is it not that, when rightly taught, it brings the student face to face with the facts of nature, with as little of the personality of an intermediary as may be? In other words, it is an appeal primarily through the eye and not through the ear. The efficient teacher of biology is often jealous of even a textbook coming between his student and the specimen before him; his most strenuous efforts are directed towards making the student see the facts for himself, instead of learning first what he is expected to see.

Contrast with this the ordinary teaching of geography by the unenlightened person, who is, alas! still too common. How many of our readers can look back to a first geography lesson which began with the immediate surroundings of the schoolroom? How long in the conscious-

ness of each was it before the facts of schoolbook and map were correlated with the actual facts of childish experience? Most of our readers have probably vivid recollections of the lists of capes and rivers, of exports and imports, and so on, which they learned off by heart without any glimmer of comprehension of their significance, or of the possibility of their being part of a uniform scheme of things, in which each fact is linked to others.

When we leave the schoolbook for the map the matter is even worse. Doubtless they do things differently now; but the writer has a vivid remembrance of the use or misuse of maps in the geography lesson. There seemed to be a general impression in the teaching mind that there was something undignified in considering the actual surroundings of the school when all the wide world lay open as depicted in the gaudiest of wall-maps. It is probable that the majority of people find as a matter of experience that maps meant nothing to them until the exigencies of a bicycling or walking tour taught them their value. Many have doubtless first appreciated the meaning of contour-lines during such an experience. The writer well remembers a day's cycle ride which was planned by its leader because of the interesting fact that the route followed two separate and distinct rivers during a part of their course. At the end of that day's ride the whole party knew something more of the nature of a watershed than all their schooldays had taught them!

It is only when one comes to make such a practical use of maps that one appreciates for the first time the utter folly of training children to look at maps without first teaching them to orientate themselves in space. We are so accustomed to look at maps hung on walls with the north upwards, or placed on a table with the north away from the observer, that the idea of placing them correctly by the points of the compass either never presents itself, or has to be slowly and painfully acquired by constant practice in adult life.

To sum up: is it not obvious that geography, like any of the natural sciences, should be so taught that its first appeal is to the eye and not to the ear; that teaching should begin with the immediate surroundings of the student, and gradually widen; that the child's first maps should be those that he makes himself, or such as can be gradually built up under his eyes by the teacher? If this be so, is it not obvious that the first essential for the teaching of geography is a view-point—a mountain top from which the student may view the kingdoms of the world. Three years ago there was outlined in this *Magazine* (vol. xviii. p. 142 *et seq.*) a scheme for a National Institute of Geography which should be, as it were, an object-lesson in the best methods of teaching geography, as well as a library and museum, and more besides. This scheme has yet to be realised on the scale on which it was planned, but we have in Edinburgh the germ of an institution on similar lines. In the Outlook Tower Professor Geddes has for a number of years been working at a model Geographical Institute; and it is felt by a number of those who sympathise with his aims that the time has come to make an appeal for public support in order that the usefulness of the Tower may be increased and

its scope of influence widened. It is proposed to hold a meeting in Edinburgh early in June to emphasise certain aspects of Professor Geddes's scheme, but the *Scottish Geographical Magazine* seems a fitting place to discuss its bearing on geographical method.

The Outlook Tower is an old building situated on the lofty ridge of Old Edinburgh immediately below the Castle, and has therefore many natural advantages of position. From it one has a superb view of Edinburgh and its surroundings, a view which is in itself an object-lesson in geography—a fitting starting-point for the study of the subject. From the summit of the Tower we have before us, as it were, the raw material of the science, the hills and valleys of the far distance, the broad Firth with its islands, and in the immediate foreground the city with its public buildings and its monuments, its streets and its houses, its historic past and its busy present. If it seem at first sight that the present is too near and too insistent for scientific analysis, here at hand is the camera obscura to select the significant for us, to eliminate the too-prominent personal note. This then is the raw material of geography; for is not geography by definition the study of the earth's relief and of the relation of that relief to the distribution of all other phenomena? There is no difficulty in convincing every one that the shape of hill and valley, the steep scarp and the rounded summit, the distribution of land and water, are all alike due to continuous and uniform natural causes acting through the ages; but when we can show that the city in all its infinite details is similarly a product of constant and uniform causes we have surely solved the problem of geography. When men learn that not chance nor caprice, not the unmotived whim of individuals, has made the City with its setting of Country, Empire, and World what it is, but the action of forces which can be studied and (at least approximately) explained, they have learned the great lesson which geography has to teach.

Again, are we concerned with the relation of the special sciences to geography? Here within reach are representative instruments of each science to show us that the true geography comes last and gathers up the results of detailed analysis. We need the help of the astronomer and his appliances to orientate ourselves in space, to survey and map the landscape before us; the geologist must give us the reasons for that surface relief upon which all the other facts depend: the botanist and zoologist are fast learning how to explain to us the why and the wherefore of those peculiarities of plant and animal distribution which are facts of observation, and they in their turn must seek the help of the meteorologist. Whether, therefore, the observer be a child at the threshold of life, or an adult student with his college years behind him, here is the point of unification, the pool from which the separate sciences flow, the origin or the end of all, according to the standpoint of the observer.

When the view tower has given us all it can, or aroused a craving for fuller analysis, descent to the first story brings us to a room arranged as an outline museum of Edinburgh, containing, *inter alia*, a model of the city, together with maps, drawings, paintings, photographs, and a type collection of books. The next room, the Scotland Room, is similarly

devoted to a collection of maps, models, and so forth illustrating the characters of the country of which the city forms a part. The survey is widened in the successive rooms of the lower stories, which are respectively devoted to the English-speaking world, Europe, and finally to the world at large. We cannot here follow out all the possible implications of the scheme, or trace its manifold possible developments, but enough has perhaps been said to indicate that here, so far as conditions allow, are summarised all that is best in modern methods of teaching geography. The scheme for the increased development of the Tower should therefore appeal to all those who have the true interests of geography at heart. More than this, it should also appeal to every true citizen, for it is an attempt to make the city conscious of itself, to correlate the commonplaces of daily life with the whole of knowledge, to illuminate them by showing them as merely part of an infinite scheme of things.

NOTES ON A JOURNEY THROUGH BRITISH NORTH BORNEO.

By Andrew Burt.

British North Borneo comprises only the various provinces forming the territory of Sabah, and was acquired from the Sultans of Brunei and Sulu in the years 1879 and 1880. This part of the Island of Borneo is governed by the British North Borneo Company, which was incorporated by Royal Charter on 1st November 1881. Adjoining Sabah or British North Borneo is the territory of Sarawak, and also that of Brunei. When speaking of British North Borneo these two territories are generally included. They are governed by Rajah Brooke, a nephew of Sir James Brooke, who obtained a grant of the territory from the Sultan of Brunei in 1842. Off the coast of Brunei is the Island of Labuan (a crown colony), which is also governed by the British North Borneo Company.

The area of British North Borneo is about 31,106 square miles, with a population of about 160,000 natives, or rather Asiatics, and about 200 Europeans. The native population includes Dussans, Dyaks, Malays, and Chinese.

The capital is Sandakan, situated on the east coast, and in direct communication by steamer with Hongkong, Singapore, and Manila. It is 1200 miles from Hongkong, 1000 from Singapore, and 660 miles from Manila.

The coast-line, which is about 500 miles long, can be followed the greater part of the way, but in one or two places the mangrove creeps out and shuts it off. Round the coast are numerous hills of from 100 to 300 feet high, but on going further inland one meets with mountains of considerable height. The highest, Kina Balu (or Chinese Widow), rises to 13,700 feet. This mountain, which can easily be seen from on board coasting steamers, is situated about 30 miles from the west coast

and 60 miles from the north coast. The majority of the rivers are navigable for light draught boats, and the three best harbours are Gaya on the west coast, Kudat on the north-east, and Sandakan on the east coast, all with a sufficient depth of water for the largest sea-going steamers.

The climate is very pleasant for the Tropics, and compared with Singapore or Hongkong it is, if anything, healthier, excepting there is no winter, which is the only advantage Hongkong has over Kudat or Sandakan. The days are seldom very hot and the nights are pleasantly cool—in fact, in driving out in the early morning one feels a sharpness in the air. The usual tropical insects, mosquitoes, etc., are to be found, but they are not so numerous or so bad as in the majority of places on the Chinese coast. The temperature is practically uniform all the year round, seldom reaching 90 degrees Fahr. maximum in the shade during the day, and falling to 75° or even less at nights.

The seasons are very regular, and are as follows :—

February, March, and April, hot and dry.
May and June, slight showers.
July, August, and September, dry.
October, occasional showers.
November, December, and January, rainy.

Roads there are none, except in the small settlements where the Europeans have their houses, and on the tobacco, etc., estates. The vast interior of the island consists of almost impenetrable forests, teeming with animal life although sparsely populated by man. The animal world is well represented by elephants, rhinoceros, deer, wild cattle, pig, bear, snakes, pythons, monkeys, and crocodiles, and there are pheasants of different kinds, wild duck, pigeons, snipe, quail, etc.

In regard to the minerals, except for the coal mines in Labuan, and those in Sarawak worked by Rajah Brooke, the mineral wealth of the country is practically unknown. In Labuan the coal mines have been worked for over twenty years, but either from want of capital or bad management they have not been opened out to any extent. The mines have changed hands repeatedly, but no system of exploitation seems to have been adopted, the natives being allowed to scratch away at the outcrops to suit themselves. A new company has again started, and it would seem as if they had set to work in earnest. An analysis of this coal was laid before the Edinburgh Geological Society in January 1882 by the late W. Ivison Macadam.

Along with that from Sarawak and Brunei, it is used by the coasting steamers which ply between Manila, Hongkong, Singapore, and Borneo. The writer, when in Borneo last year, paid a visit to the Labuan mines just after the company had been reconstructed, and was taken down a new inclined shaft which was being driven in the lowest workable seam. This is a 10-feet seam, and above it are three more seams, 3 feet, 2 feet, and 4½ feet respectively. There is a very large area of coal in this field, and the outcrops extend across the northern portion of the island and dip seawards, so that in all probability a large area may be found under sea.

Another large field (Marudu Bay coalfield) which the writer had occasion to report on lies to the north-west, on the promontory between Kudat and Sandakan.

In this field eight seams of coal were met with ranging from 2 feet 6 inches up to 13 feet 9 inches thick, and dipping from 15 to 45 degrees. The strike of the seams was ESE. and WNW., and dipping towards the south. The thickest seam, which was also the top seam, was 13 feet 9 inches thick, including two bands of clay each 1 foot thick; the other seams were as follows:—

Lowest seam,	No. 1,	4 feet 6 inches.
	No. 2,	5 feet 0 inches.
	No. 3,	6 feet 0 inches, with 2 feet of clay.
	No. 4,	2 feet 6 inches.
	No. 5,	3 feet 6 inches.
	No. 6,	3 feet 0 inches.
	No. 7,	7 feet 0 inches.
	No. 8,	13 feet 9 inches, with 2 feet of clay.
or a total thickness of		41 feet 3 inches of coal.

The area of this field as reported on was about 10 miles long by $4\frac{1}{2}$ miles broad, and as far as could be ascertained from the exposures on the sea-coast and in the gullies in the jungle, had the appearance of being very free from faults and dislocations.

One peculiarity of the coals in the Tropics is that they have practically all the same characteristics, the coal in Sumatra and Java being of practically the same appearance and nature as those in Dutch Borneo and British Borneo.

An analysis of (Marudu Bay coal) the above coal-seams gave the following:—

Moisture,	9·65
Volatile matter,	38·95
Carbon,	48·52
Ash,	2·88
	100·00

Calorific power = evaporates 12·08 lbs. of water per pound of coal.
Specific gravity (water 100) = 1·327

The clay found in No. 8 seam of coal gave the following analysis:—

Moisture,	2·91
Silica,	69·60
Alumina,	22·50
Iron,	3·49
Other impurities,	2·50
	100·00

On the east coast several outcrops have been found near Sandakan,

and further south towards Cowie harbour. The latter have been taken up by a London syndicate, and work has already started on the field.

Manganese has been found in Marudu Bay on the opposite side from the town of Kudat near a place called Taritipan, and it also is being exploited.

In Sarawak and Brunei gold, silver, antimony, mercury, coal, and diamonds are being worked at present, and it is not too much to expect that British North Borneo and Sabah would produce the same minerals if sufficiently prospected. Oil is found in small quantities throughout British North Borneo, and a feeder of oil was struck in one of the coal-mines belonging to Rajah Brooke in 1903 which gave off a considerable quantity.

One disadvantage of the situation of these coalfields and mineral fields is the labour. The natives are practically useless as workmen. They prefer to go hunting in the jungle or growing a small patch of paddy. Chinese and Malays have to be imported for any mine work or even for the cutting of timber, in which a very large export trade is carried on. The Chinese, however, get acclimatised very quickly, and get on well. They make good workmen on the tobacco, etc., plantations, and the few who have been employed at the Labuan mines have settled down with their families, and seem healthy and contented.

ANTARCTICA.[1]

THE first-fruits of the Swedish Expedition have recently appeared in the handsome volume now before us, in which Dr. Nordenskjöld and his colleagues give an account of their experiences in the Antarctic. We have already published here a series of notes on the work of the expedition, so that it is unnecessary to repeat the story of the chapter of accidents which led to the fact that there were during the Antarctic winter of 1903 no less than three wintering parties belonging to the expedition, all within comparatively short distances of one another, though not in communication. These were the original wintering party under Dr. Nordenskjöld at Snow Hill, the shipwrecked party from the *Antarctica* at Paulet Island, which lies off Dundee Island and not far from Joinville Island, and finally the small party consisting of Dr. Andersson and two companions, which was landed in the sound (Antarctic Sound) between Joinville Island and the mainland in the hope of being able to communicate with the Snow Hill party. All three parties were finally rescued by the Argentine ship *Uruguay*.

Of these three parties that at Snow Hill, though its members did not expect to spend two winters in the Antarctic, were the best off in the sense that they were furnished with a comfortable house, and with the necessities of existence. The two other parties had to depend upon

[1] *Antarctica; or, Two Years among the Ice of the South Pole.* By Dr. Otto Nordenskjöld and Dr. Joh. Gunnar Andersson. *Price* 18*s. net.* London: Hurst and Blackett, 1905.

their own exertions alike for shelter and food. In the case of the Paulet Island party one member died from heart disease, but all the others came safely back to civilisation, and those who are familiar with the literature of Arctic exploration will be astonished at the comparative freedom from severe hardship which the narrative sets forth. The fact that none of the parties suffered severely from want of food is due to that characteristic bird of the Antarctic area, the penguin. Near all three stations were penguin rookeries, and these helpless birds furnished an abundant and readily available supply of food, while seals and—in the case of the Paulet Island party—fish were important additions to the bill of fare. As regards Paulet Island, it is of interest to note that the articles on "Antarctic Exploration" contributed to this *Magazine* in 1894 by Dr. Donald and Mr. Bruce (x. pp. 59 *et seq.*) contain illustrations and descriptions of this island and the neighbouring land-masses. The illustrations in the article show well the general character of the island.

Owing to the separation of the members of the expedition, Dr. Nordenskjöld has arranged that the experiences of the various groups shall be narrated by those who took part in them. In consequence, while he and Dr. Gunnar Andersson, as indicated in the title-page, are responsible for the greater part of the volume, Capt. Larsen and the botanist, Mr. C. J. Skottsberg, have also contributed chapters. The latter describes the shipwreck and the experiences of the shipwrecked party on Paulet Island; and whether because of the intrinsic interest of his narrative, or because the author shows marked literary ability, there can be no doubt of the special charm and freshness of these chapters. Any one who has collected under difficulties will sympathise intensely with the grief felt by the scientific members of the staff at the loss of so many of their cherished collections when the ship went down, and every one, we are sure, will rejoice that so much was saved. Perhaps the most delightful bit of the book is Mr. Skottsberg's account of how he saved his precious herbarium. He had had the great foresight to prepare a collection of the most cherished of his plants in very small bulk in case of a disaster. One thing was, however, needed to complete his preparations, and that was a waterproof covering. A piece of oilcloth on the gunroom table caught his observant eye as exactly the thing needed, and some time after the vessel was first nipped he appealed to the captain for permission to appropriate this. Capt. Larsen, however, indignantly rejected the implied assumption that the case was hopeless, so the prudent botanist was fain to bide his time. But time, alas! brought conviction even to the gallant captain, and a second appeal for the oilcloth was successful. In it the plants were carefully wrapped up, and in it they were brought safely through the vicissitudes of the shipwreck, the subsequent wandering on the ice, and the dangers of the winter. The fates must indeed be cruel if that cherished parcel does not contain some new species whose names may immortalise the zeal of their collector!

It would be impossible here to attempt to summarise all the scientific results of the expedition, even so far as they are detailed in the volume

before us. It does not, of course, profess to be more than a narrative of the expedition, and the scientific results are to be published separately, and will then be noticed here. We can only indicate the lines along which progress has been made. The scene of the labours of the expedition was, as we have seen, Louis Philippe Land and Graham Land; but as there is considerable confusion in the nomenclature of the details of this region, and as it is on general grounds convenient to have a name for this part of the Antarctic Continent, Dr. Nordenskjöld suggests the name of West Antarctica for the whole region which lies to the south of South America, reserving the name of East Antarctica for the other well-known mass of Antarctic land, that in the vicinity of Victoria Land.

Adopting this name, then, we find that the result of the Swedish Expedition has been to produce considerable changes in the mapping of West Antarctica, and further, when the soundings made by the vessel have been fully studied and compared with those taken by the *Scotia* in the Weddell Sea, there is little doubt that it will be possible to draw a considerable number of interesting conclusions in regard to the problems of land and sea in this region. Further, as we have already mentioned in these pages, the expedition has been specially fortunate in obtaining fossils. When these fossils have been fully worked out, and the volcanic rocks found by the expedition in many localities studied in detail, we shall undoubtedly know much as to the former distribution of land and water in West Antarctica. It is quite possible also that the study of the geological specimens will decide the much-debated question of a possible former connection between South America and the Antarctic region. In connection with the ice of the region a very interesting point is the discovery of an ice-terrace off the east coast of Graham Land which presents some points of resemblance to Ross's famous barrier near Victoria Land. (Cf. p. 320 of this number.)

Again, the meteorological results, when collated with those made by Mr. Mossman at the station at the South Orkneys, will doubtless throw much light upon the climate of Antarctica.

But it lies with the future to show all the scientific results of the expedition, and our present purpose is rather to recommend Dr. Nordenskjöld's book as giving a vivid and most interesting account of parts of West Antarctica. The narrative not only details the experiences of the three parties, but also describes the explorations undertaken by members of the expedition at Tierra del Fuego and at South Georgia, the latter being of extreme interest. It is furnished with two very useful maps, and many illustrations, and makes exceedingly interesting reading. Of the illustrations undoubtedly the most interesting are the photographs, some of which are exceedingly good. A number of others have been drawn for the book partly from photographs, but largely, we suspect, from the imagination of the artist. Many of these have no intrinsic beauty, and we are disposed to regard their inclusion as a bad precedent, and on various grounds as unfortunate.

THE SCIENTIFIC RESULTS OF THE NATIONAL ANTARCTIC EXPEDITION.

At a meeting of the Royal Geographical Society of London, on 27th February, Captain Scott discussed the scientific results of the National Antarctic Expedition, with special reference to the distribution of land, water, and ice in the area investigated by the party, and his paper appears in full in the April issue of the *Geographical Journal*.

One of the most interesting of the questions involved is that of the probable shape of the Antarctic Continent. It will be recollected that, owing to the very various points of approach of the different recent expeditions, we have now a considerable amount of information as regards the land within the Antarctic Circle, though meantime there are still great blanks which remain to be filled by the linking up of the work of the different expeditions. It will be remembered that the work of the *Belgica*, of the Swedish Expedition, and of the last expedition—the Charcot Expedition, of which we have only recently had news—has in each case been carried out in the vicinity of Graham Land. Considerably to the east of Graham Land the Scottish Expedition discovered Coats Land. The next discovery of land, still proceeding eastward, is that found by the German Expedition, which lies much further to the north than Coats Land; for while the latter was first seen in lat. 72° S., and trended to the south-west, Kaiser Wilhelm II. Land lies just within the Antarctic Circle, between Kemp Land and Knox Land. Continuing our progress to the east we come to the coast of Victoria Land, and to the scene of the labours of the British Expedition. It will be recollected that this expedition not only followed the coast of Victoria Land much further to the south than had ever been done before, but also discovered King Edward VII. Land at the eastern end of the great ice-barrier. If, then, we take the two points of Victoria Land and Graham Land as the best-known regions of Antarctic land, the question which remains is, What light do the recent expeditions throw upon the possible connection of these two points? Taking Victoria Land as the starting-point, it is clear that the eastward extension of land will be that facing the South Pacific, and the westward that facing the Indian and Atlantic Oceans. As to the eastward extension, two possibilities present themselves. It will be remembered that Captain Scott and his companions in the great sledge-journey found that the mountainous coast of Victoria Land runs approximately north and south, and the party was able to observe this coast-line as far south as the 84th parallel without observing any change of direction. It would therefore appear that this coast-line may run right on till it joins the land in the vicinity of Graham Land, and thus form the Pacific boundary of the Antarctic Continent. If this hypothesis be correct, then King Edward Land must form an island, or a separate continental area. Another possibility is that beyond the 84th parallel the coast of Victoria Land sweeps round and joins King Edward Land, so that

the great ice-barrier is enclosed in a great bight. There are still other possibilities, for the hypothesis that there is one great continental area in the Antarctic has no very secure foundation in observed fact. There may be more than one great land-mass.

As to the westward extension of Victoria Land, there is also considerable uncertainty. Apart from Kaiser Wilhelm Land, land has been charted between Cape Adare and Enderby Land; but whether the coast-line does or does not follow the present line of Wilkes Land, as shown on the maps, it seems at least possible that a continuous coast-line stretches from Cape Adare by Coats Land to Graham Land, and that between this coast and the coast of Victoria Land there stretches the great ice-covered plateau over which the westward journeys of the party from the *Discovery* were made.

It will be noticed from the above that, great as have been the additions to our knowledge of the Antarctic Continent made by the recent expeditions, much still remains to be done before the Continent can be said to be adequately known.

As regards icebergs, Captain Scott states that the main supply of these is from the edge of the Barrier and the vicinity of Edward VII. Land. The glaciers on the coast-line of Victoria Land are in a state of stagnation, and between Cape Adare and Cape Crozier there are only two ice-flows capable of giving off bergs of any dimensions. As regards size, few bergs were seen which exceeded a mile in length and 150 feet in height. Captain Scott is of opinion that the proportion of the submerged to the visible ice is not greater than about 5 to 1, instead of 7 to 1 as estimated by Sir John Murray.

In our previous notes on the work of the expedition we have already described the great cap of inland ice which covers the plateau of Victoria Land, and there is little more to be added to these previous descriptions. Very few of the glaciers of the coast of Victoria Land run back to the inland ice, and of these some are stagnant, lying practically stationary in their valleys. The Ferrar glacier is an example of one of these stationary glaciers, and shows marked signs of retrogression. Mr. Ferrar estimated that its surface had formerly been 3600 to 4000 feet above the present level.

Great interest centres in the observations made by the members of the expedition on the Great Barrier, a unique structure of much importance. It will be remembered that the Barrier stretches from the coast of Victoria Land to Edward VII. Land, which is apparently the "appearance of land" noted by Ross. The most obvious suggestion as to its origin is that it is the edge of a great stream of ice pouring out from the land to the south into a great bay enclosed between Victoria Land and the continuation southward of Edward VII. Land. Captain Scott, however, believes that the great ice-sheet is afloat at least throughout its greater portion, and is inclined to ascribe its origin to a former period of greater ice-extension. He believes that when the ice stood at its maximum the glaciers from the inland ice of Victoria Land streamed out into the shallow Ross Sea, and there united, forming a huge ice-sheet. As the severity of glaciation diminished, he believes that this ice-sheet

broke away and became buoyant, a remnant of it still persisting to form the present ice-sheet. In this connection it is of interest to note that the Swedish Expedition found off the coast of Graham Land an ice-terrace terminating towards the sea in a wall, comparable on a small scale to the Ross Barrier. Dr. Nordenskjöld is inclined to believe that this curious terrace may have originated *in situ* in the sea. The whole subject is one of extreme interest, and is one of the many problems which still remain to be solved.

As regards climate, Captain Scott makes an interesting statement that in his opinion during the maximum of glaciation the climate in the Antarctic must have been milder than at present. The expedition found that the snowfall was greater in summer than in winter, and that the Balleny Islands are more severely glaciated than Victoria Land. Similarly Mr. Ferrar describes the climate as being perfectly dry (cold desert condition), owing to the temperature of the air being always below the freezing-point of water. If this be the case—that is, if a rise of temperature would produce an increase in the degree of glaciation in Victoria Land, some far-reaching modifications may have to be made in our conceptions in regard to Ice Ages; but in the first instance the meteorological results of the expedition will require to be fully worked out, for there are many detailed points as regards the snow-carrying winds which require to be explained before general conclusions can be drawn.

The same number of the *Geographical Journal* which contains Captain Scott's paper also contains various papers by members of his staff, as well as one on the Antarctic sea-ice by Captain Colbeck. Mr. Ferrar contributes a paper on the physical geography of the Antarctic, in which he describes the rocks found in Victoria Land, and the topography of the region. The rocks consist chiefly of volcanic and plutonic beds. Granites of apparently two ages were found, one with a horizontal upper surface, and the other apparently intrusive. Basic lavas, tuffs, phonolites and basalt were also found. The most interesting discovery, however, is a sandstone, to which Mr. Ferrar has given the name of the Beacon Sandstone Formation. It is 2000 feet thick, and covers an extensive area. It is capped by basalt, which occupies the highest ground that has been ascended in Victoria Land, and also occurs as dykes and sills in the sandstone. At one point a thin carbonaceous seam was found at the junction of the sandstone and basalt which proved to contain fossil plants, but unfortunately these are in such a bad state of preservation that identification has proved impossible.

As regards topography, it is already known that the southern portion of Victoria Land is fringed by a lofty range of mountains culminating in heights of 15,000 feet. The lower part of this range is about 4000 feet high, and there is no extensive area of land lower than this. From the littoral range there stretches inland over the whole of the known part of the interior the great plateau of inland ice, with a height of about 9000 feet. In addition to the main mountain range there are a series of isolated volcanic cones, of which only Mount

Erebus is still active. The cones lie at the base of the range, in comparatively low land, and usually slope directly into the sea. All are of considerable height, and cover large areas. The more important of the cones are Erebus (12,760 feet), Terror (10,884 feet), Discovery, and Melbourne (8560 feet). The mountain range is singularly bare of ice, which is to be accounted for by the precipitous slopes.

In the discussion which followed the reading of Mr. Ferrar's paper a very interesting fact was pointed out by Mr. Teall. He emphasises the fact that, although the Victoria Land Range extends for about 600 miles, and contains some very high peaks, yet Mr. Ferrar's observations make it clear that it is not, as might be expected, a range of the folded or Alpine type, but consists of apparently horizontal beds of sandstone, capped by basalt, and possibly resting on gneisses and granites. The horizontal beds forming the mountains are abruptly truncated at the shore. Now it is obvious that these horizontal beds must formerly have extended to the east, over the region now occupied by the sheet of ice ending at Ross's Barrier. Is their present absence in this region due to denudation, or does it indicate that the eastern rocks have sunk downwards? To fully solve this problem it would be necessary to follow Edward VII. Land southwards, and ascertain its structure and the relation of its beds to those of Victoria Land. Again, Mr. Teall points out that, while Mr. Ferrar's observations indicate that water is now playing little if any part in denudation, yet the topography and rock-surfaces suggest that water at one time must have played an important part. This is but one more proof afforded by the region of variations of the climatic conditions in former times.

The other papers read by the members of the expedition deal with the meteorology, the animal life, and so forth. In regard to the meteorology we can only note here that the blizzards from which the expedition suffered so much came from the south and south-west, and were accompanied by a rise of temperature. A very similar observation was made by the Swedish Expedition, and it is expected that this fact will prove of great importance because the occurrence of winds of this type should enable meteorologists to make deductions as to the distribution of land and water.

The above abstract may perhaps help to make clear the fact that, great as have been, from one point of view, the additions made to knowledge by the recent expeditions, yet from another standpoint they have hardly done more than show us the problems which require solution.

SCOTTISH NATIONAL ANTARCTIC EXPEDITION.

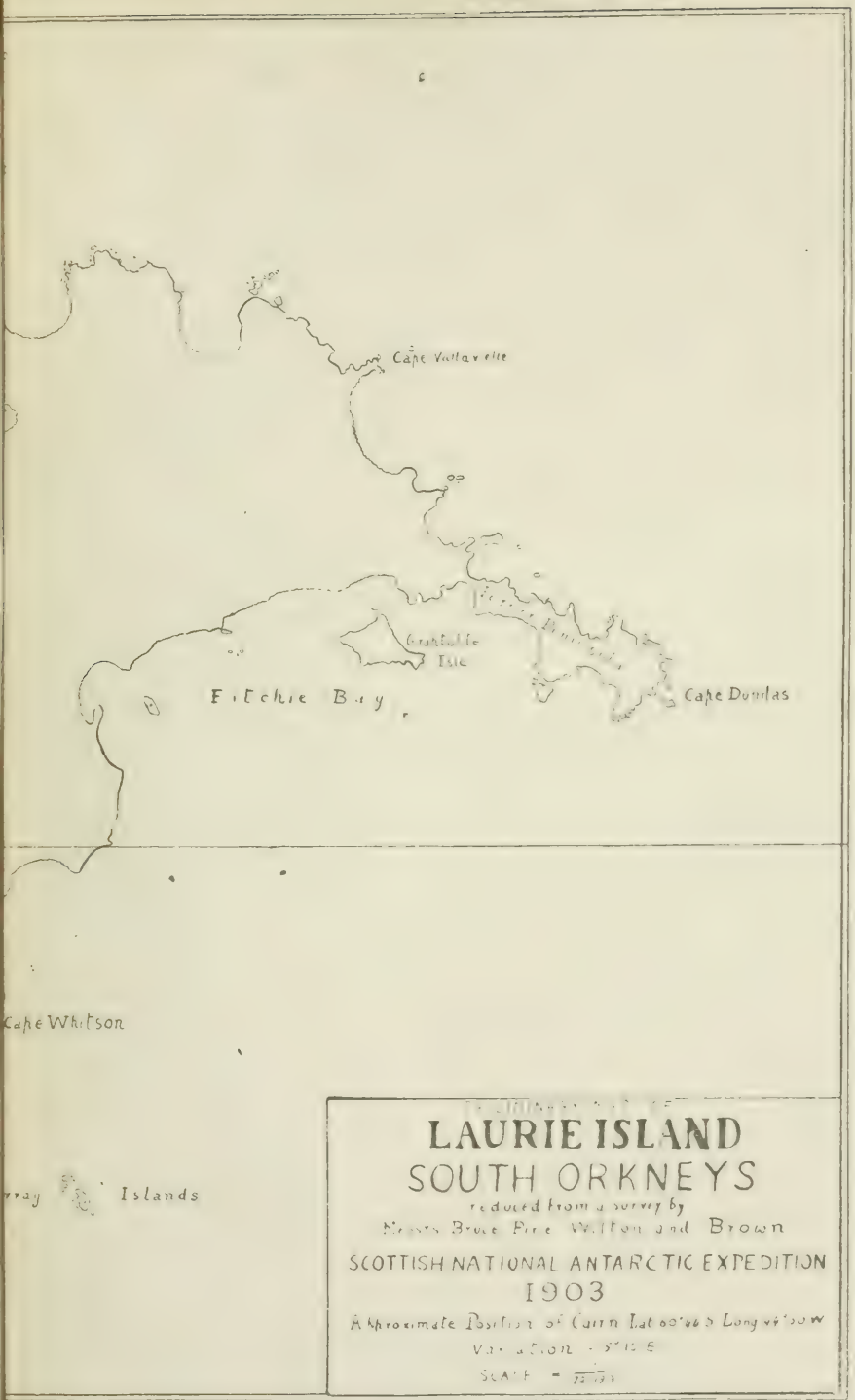
OUTLINE MAP OF LAURIE ISLAND, SOUTH ORKNEYS, 1903.

By William S. Bruce.

(*With Map.*)

This is a preliminary sketch from a more detailed map which will appear at a later date, the coastline being alone indicated. It is reduced from a two-inch-to-the-mile survey made in co-operation with Dr. J. H. Harvey Pirie, Mr. D. W. Wilton, and Mr. R. N. Rudmose Brown, who took part in the various sledge and boat journeys around the islands during the wintering of the *Scotia* in Scotia Bay. I am indebted to Captain Thomas Robertson for the latitude and longitude of the Central Cairn, which is approximately 60° 44′ S., 44° 50′ W., and to Mr. Robert C. Mossman for the observations on Magnetic Declination, the variation being 5° 15′ E. I have thought it important to publish this preliminary map, especially in the interests of navigation, as all previously existing maps are very far from correct. The survey having been carried out with the greatest care, there need be no doubt whatever about any part of the coast, except about 3 miles of the west coast of Mackenzie Peninsula and the west side of Eillium Isle, and even these are approximately correct. The position of Cape Roca, named after the President of the Argentine Republic, is, however, correct, as well as Cape Robertson and Cape Davidson. The west coast of Pirie Peninsula in fainter line was not surveyed in such detail as the remaining portion, but it is very approximately correct. In this reduced map no attempt has been made to show the nature of the interior, or of the bottom of the sea as depicted by about 500 soundings. A number of names have been omitted. In spite of the previous defective charts the names Route Point, Cape Vallavielle, Cape Dundas, and Murray Isles have been retained in recognition of the splendid services of Powell, Weddell, and D'Urville, whose short stays at the South Orkneys did not enable them to carry out detailed survey.

The island is a most remarkable one as far as shape is concerned, consisting of a series of narrow peninsulas, four of which (Mackenzie, Pirie, Ferguslie, and Watson Peninsulas) point northwards with deep bays (Jessie, Brown, and Macdougal Bays) between them. Another, Mossman Peninsula, forms the western boundary of Scotia Bay, while at the eastern end of the island comes Ferrier Peninsula, with Cape Dundas at its extremity. Between Uruguay Cove and Scotia Anchorage the island is almost divided into two, there being at this point the only low-lying piece of ground of any extent in the whole island. On this, The Beach, are situated the Central Cairn, Omond House, and Copeland Observatory. In Fitchie Bay is Graptolite Island, so named from Dr. Pirie's important find there of fossils which have determined the age of the South Orkney Rocks, and which, along with those of the Swedish



LAURIE ISLAND
SOUTH ORKNEYS

reduced from a survey by
Messrs Bruce Pirie Watson and Brown

SCOTTISH NATIONAL ANTARCTIC EXPEDITION
1903

Approximate Position of Cairn Lat 60°46'S Long 44°30'W
Variation - 5°12 E
SCALE - 1/12 000

N
Cape Buchanan
Cape Mabel
Eastmore Rock
Cape Geddes
Macdougal Bay
Point Thomson
Brown's Bay
Jessie Bay
Cape Robertson
Route Point
Mackenzie Peninsula
Uruguay Cove
Scotia Anchorage
Point Moreno
Cape Rosa
Cape Davidson
Wilton Bay
Mossman Peninsula
SCOTIA BAY
Point Davis
Point Rae
Mill Cove
Cape Whitson
Cape Nan Anderson
Point Martin
Buchan Bay
Cape McVitie
Cape Burn Murdoch
Ailsa Craig
Murray Islands
Fitchie Bay
Cape Dundas
Cape Vanderville
Grantsville Isle
LAURIE ISLAND
SOUTH ORKNEYS
reduced from a survey by
Messrs Bruce Pirie Wilton and Brown
SCOTTISH NATIONAL ANTARCTIC EXPEDITION
1903
Approximate Position of Cairn Lat 60°38'S Long 45°30W
Variation - 5°15 E
SCALE - 1/63360

Expedition, form our only present contribution towards a knowledge of the palæontology of the Antarctic Regions.

The titles of the illustrations of Laurie Island, which have already appeared in this Magazine, may be amplified from the accompanying map, as follows :—

Frontispiece, facing p. 57, vol. xx. (1904) : *Scotia* in Scotia Bay, hills of Mossman Peninsula in background.

Fig. 1, vol. xxi. (1905) p. 24 : Omond House, on "The Beach."

Fig. 2, vol. xxi. p. 25 : Weddell and Saddle Islands, South Orkneys.

Fig. 6, vol. xxi. p. 31 : Watson Peninsula, from camp on east side of Ferguslie Peninsula in Macdougal Bay.

Fig. 7, vol. xxi. p. 32 : Cape Dundas and Ferrier Peninsula at eastern extremity of Laurie Island.

Fig. 8, vol. xxi. p. 33 : Glacier at head of Macdougal Bay, from camp on east side of Ferguslie Peninsula.

THE RECENT VOYAGE OF THE *URUGUAY*.

By R. C. Mossman, F.R.S.E.

(*With Chart and Illustrations.*)

The Argentine sloop-of-war *Uruguay*, under the command of Captain Ismael Galindez, left Buenos Ayres on December 10 for the South Orkney Islands to relieve the meteorological observers left there by the *Scotia* on her return south in February 1904. After calling at Ushuaia for coal and water, a course was shaped for Saddle Island. On the 30th at 4 A.M., when in latitude 58° 30′ S. and longitude 51° 16′ W., the first iceberg was encountered. It was of triangular form and one mile long, while that portion above the sea was estimated at 150 feet. Soon after the pack-ice was fallen in with, while the ship was yet distant 250 miles from the Orkneys. At first it was loose, but close to the islands, or in lat. 59° 45′ S., long. 46° 30′ W., some very heavy and compact pack was met with. Fortunately there was open water on the north side of Coronation Island. The wind at the Orkneys had been blowing from the south and south-west for over six weeks, so that the pack-ice had been driven a few miles off shore. A further favourable circumstance was the unusual clearness of the atmosphere, which greatly aided navigation. The *Uruguay* dropped anchor in the north bay (now called Uruguay Cove) at 9 P.M. on December 31. Immediately on her arrival preparations were begun for landing stores and coal for a new party of five men sent down by the Argentine Meteorological Office to continue the work for another year. A new magnetic house for the variometers was in process of erection, and some additional lumber was also landed. The conditions were at first very favourable for this work. The sea in the bay was perfectly still, and there was no swell, so that the numerous packing-cases, sacks of coal, etc., could be put ashore without difficulty and dragged up on the ice-foot. On the morning of January 1 the weather, which had been exceptionally fine and clear, broke down, with thick mist and snow, and as the northerly wind which set in

threatened to fill the bay with heavy pack, the embarkment had to be got through without the loss of a minute's time. By 5 P.M. all the stores for the new party had been landed, and our own boxes and natural history specimens taken on board.

The *Uruguay* left the bay at about 10 P.M., during a temporary clearing of the weather, bound for the South Shetland Islands and Gerlache Strait, at which places dispatches from Charcot's French Expedition were expected. At first the pack gave little trouble, and from 4 to 8 P.M. on the 2nd the navigation was through open water. During the forenoon of the 3rd heavy ice was again entered, and about noon, the open sea

Hot Springs in Pendulum Cove. (Cf. chart, p. 326.)
(The steam rising from the springs is seen at the left of the figure).

being observed about five miles off, the ship's course was changed to north so as to get out of the ice as quickly as possible—a measure all the more necessary as the vessel was not sufficiently strong to encounter heavy pack. During the five hours we were occupied in gaining the open, we momentarily expected the propeller and rudder to be carried away. Much of the ice met with consisted of those large blocks called "growlers," so common at the edge of the pack. These had long deep tongues, which at times projected a long way under the vessel's stern. The pieces were so close together that there was no room to manœuvre the ship, so that all hands were kept busy with poles and oars pushing them off the ship's sides. There was fortunately no swell, and by 5 P.M. we were in open water, much to every one's relief, as every now and then the screw and rudder would be struck by an ice-block. Some Weddell seals were

observed lying in the pack. Soon after clearing the ice the sea rose, and during the next three days heavy seas were experienced.

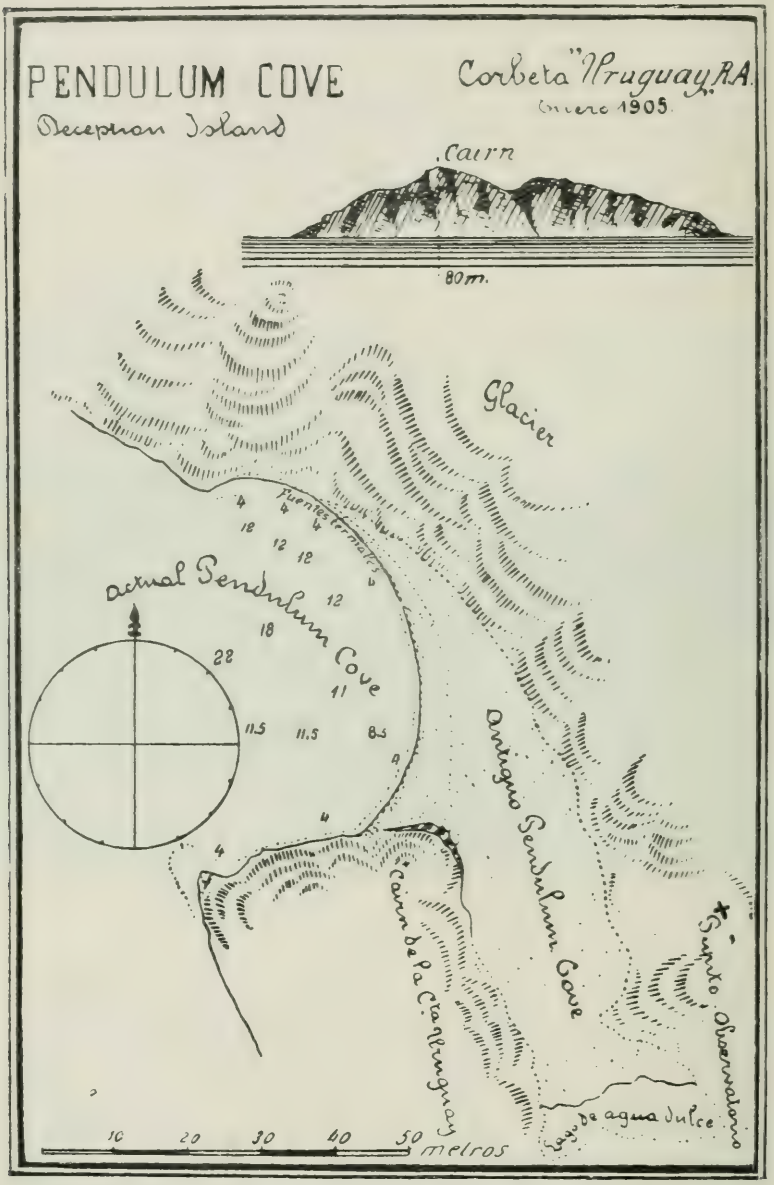
About 10 A.M. on the 7th the South Shetlands were sighted, Cape Melville being passed at six the same evening. No pack-ice was visible, but close to Cape Melville no less than sixty-two icebergs were counted, many of them aground. The South Shetlands presented an inexpressibly desolate and inhospitable appearance, being entirely covered with snow and glaciers, except in one or two places where there is bare rock. On the 7th Cape pigeons, Wilson petrels, and giant petrels continued to follow the ship, and many whales were seen.

On the early morning of the 8th we anchored in the crater harbour

The *Uruguay* anchored in Pendulum Cove, Deception Island.

of Deception Island (lat. 62° 56′ S., long. 60 40′ W.). This island, or shell of an island, is certainly one of the most singular of Nature's productions. Entrance to it is obtained on the south-east side through a narrow channel of only 550 feet across, which leads to a large elliptical basin of about five miles in diameter. The external shores form a perfect barrier or wall, thus affording the utmost security within. When the island was visited in 1829 by Captain Forster, in command of H.M.S. *Chanticleer*, numerous fumaroles were seen, from which hissing jets of steam escaped, and hot springs with a temperature of 190·4° F. were met with near the shores of the basin. Smiley, the American seaman who called at the island in February 1842, reported that the whole southern side was in full volcanic activity, there being no less than thirteen

"active centres" of eruption. In November 1902 Captain Larsen of



Pendulum Cove as surveyed by the *Uruguay* in January 1905, showing the changes which have occurred recently.

the *Antarctic*, then proceeding to the relief of Nordenskjöld, was prepared to land a party on Deception Island in order to investigate

its condition; but as the narrow entrance to the basin was blocked by pack-ice, which also filled the interior, all idea of investigation had to be given up. As there were no reports available of the state of the island since Smiley's visit in 1842, it was with much interest that we entered on our investigations.

The harbour of Pendulum Cove was found almost entirely filled with ice and ashes, and close to the observatory spot of Forster there was a small lake, probably due to the melting of snow from the heights in the vicinity (see chart). Owing to the quantity of detritus mixed with the water it was in a semi-liquid condition. The hot springs were in an active state, but I did not observe any signs of volcanic activity on land.

Glacier and Waterfall in Beagle Channel.

From a comparison of Forster's soundings with those made by the *Uruguay*, it was found that in the seventy-six years that have elapsed since his visit there is a difference of 42 feet, because where he got 25 fathoms of water there are now only 18. Whether this is due to a general elevation of the land or to a filling up of the basin by volcanic emanations is a matter of conjecture. Among the animal life observed in Deception Island were Weddell and Ross seals, Gentoo and Ringed penguins, black-backed gulls, and giant petrels. Numerous Cape pigeons were observed at the narrow entrance to the basin, so that it is very probable that this is one of their breeding-places.

No dispatch from Dr. Charcot being found at Pendulum Cove, a record was left on an adjacent height in a conspicuous position. There

being a strong gale from the north-east, with heavy and continuous snow, we were detained in Deception Island till 6 P.M. of the 9th, when the weather cleared. Our destination was Wiencke Island, at the southern end of Gerlache Strait. During the early morning and forenoon of the 10th we passed through some very fine scenery. Here could be seen the processes involved in the spawning of icebergs, the glaciers which formed the sides of the strait being much crevassed and projecting into the sea for a considerable distance. About 1 P.M. we reached the south end of Wiencke Island, having coasted along its shores for two hours without seeing any cairn or beacon in which Charcot might have left a dispatch. We could not examine the west side of the island, as the northern entrance to Neumayer Channel was closed with a line of icebergs. It was the commander's intention to proceed south-west into the Pacific, but progress in this direction was barred by heavy pack-ice which completely filled the mouth of the strait from Cape Lancaster to Cape Renard. For this reason we were unable to enter Neumayer Channel from the south in order to complete the examination of Wiencke Island. Being now in lat. 64° 57′ S., long. 63° 40′ W., we had to return the way we came owing to the unfavourable ice-conditions to the south. In the early evening it began to snow, and blow hard from the north-east, with a rapidly falling barometer and a heavy sea, so that, having reached the shelter of Two Hummocks Island at 10 P.M., we lay-to for the night in a heavy snow-storm with many rapidly moving icebergs about. The gale moderating about midday of the 11th, the homeward voyage was resumed. On the 12th we sighted Smith Island (lat. 62° 53′ S., long. 62° 35′ W.), but could not see much of it for fog. In the afternoon during a thick fog the *Uruguay* encountered an iceberg of colossal dimensions. It was fortunately observed when about a ship's-length off, but so close were we that the yards barely cleared its face as we swung past.

Cape Horn was sighted on the forenoon of the 15th, the Beagle Channel being entered in the early evening. At night we dropped anchor at Harbourtown, where we remained a day, arriving at Ushuaia, the capital of Tierra del Fuego, on the 17th. Here we were detained a week while the ship's boilers were being cleaned. On the 24th we left for Punta Arenas, which owing to bad weather was not reached till the 28th. The commission of the *Uruguay* terminated at Buenos Ayres on February 8th, the total distance traversed being 6184 miles.

OBITUARY.

Alexander Begg, 1825-1905.—We regret to record the death at New York, on March 19, of Mr. Alexander Begg, who since 1896 has been a corresponding member of the Society, and was a frequent contributor to the *Magazine*. Mr. Begg was a native of Caithness, and emigrated to Canada in 1846. In addition to a large amount of newspaper work, he wrote a *History of British Columbia*, and was at one time Emigration Commissioner to Scotland for the Government of Ontario.

He gave evidence for the Government of British Columbia before the Alaskan Boundary Commission, on which topic he contributed an article to the *Magazine* in 1901.

GEOGRAPHICAL NOTES.

Europe.

Rainfall of Ben Nevis Observatory.—We have received a pamphlet on this subject, by Mr. Andrew Watt, M.A., reprinted from the *Journal of the Scottish Meteorological Society* (xx.-xxi.). The pamphlet contains a large amount of interesting matter, and will accentuate the widely felt regret that this important series of observations has been interrupted. The closing of the Observatory is the more to be regretted in that the records have been kept for nineteen years; but as it has been proved by Dr. Mill that nothing less than a thirty-year period is sufficient for the determination of a satisfactory average for any given station, the stopping of the station largely nullifies all the patient work already done.

The height of the summit gauge on Ben Nevis is, or was, 4405 feet, while the low-level station at Fort William is 31 feet above sea-level. The observations on the summit, in Mr. Watt's tables, are calculated for the nineteen-year period from 1885 to 1903. The low-level Observatory was not in operation till 1890, but previous to this records were kept at the schoolhouse close by, and as simultaneous observation of the gauges at these two places during a period of seventeen months showed no very marked differences between the two, the two series of observations have been combined for purposes of tabulation.

The result of tabulation is to show that, during the nineteen-year period, the mean annual rainfall at the summit was 106·78 inches, as compared with a mean of 78·58 at the base. Taking individual years it is found that, generally speaking, there is agreement between the two records, a low rainfall at the summit being associated with a low rainfall at the base, and *vice versa*. This is not, however, invariably true, for in 1886, the driest year on record for the summit with only about two-thirds of the normal fall, the shortage at Fort William was less than 10 per cent.

A comparison of the Ben Nevis record with that at the Stye in the English Lake district, with a height of only 1077 feet, shows some interesting points. Here the average annual rainfall for the same nineteen-year period gives an average of 170·29 inches, that is, it exceeds the Ben Nevis average by 9½ inches. On the other hand, the Stye rainfall shows a much lower range of variation than the Ben Nevis fall.

Asia.

The Indian Earthquake.—On the morning of April 4 a severe earthquake shock occurred over a large part of North-Western India.

The shock was of Himalayan origin, and had its centre at Dharmsala, the area in which serious damage was done being included within a line drawn from Shahpur through Kangra to Jawalamukhi, thence east to Sujanpur and then to Baijnath. Two days before the first shock was felt in India the Punjab stations recorded the arrival of storms bearing large quantities of dust and ash, and according to native reports a volcanic eruption has recently occurred in Bashahr State. The earthquake was recorded by the seismographs at Edinburgh Royal Observatory, at Göttingen, and in the Isle of Wight. The following notes on the geography of the Kangra Valley, which was devastated by the shock, were communicated by a correspondent to the *Times*:—

"The Kangra tea-growing district stretches from Dharmsala and the town of Kangra (which are within ten miles of each other, due north and south) to the state of Mundi, a distance of about thirty-five miles to the eastward. It lies along the base of the Chumba range of the Himalayas, the tea plantations nestling in a narrow belt whose elevation varies from 3000 feet to 6000 feet above the sea-level, and whose width is never more than four or five miles. Palampur, twenty-two miles to the east of Dharmsala, is the central station of the planting district. It is a small bazaar, containing perhaps 2000 inhabitants, with a Thesilder's court-house, a hospital, a dâk-bungalow or travellers' rest-house, and the planters' church, which is, perhaps it is more correct to say was, the most beautiful of any in India. No European officials resided at Palampur. The so-called valley is a sub-montane tract, lying between the River Beas and the mountains; the lower portion is marvellously fertile, yielding golden crops of wheat in the cold weather, and rice and Indian corn in the monsoon season. Although fairly flat from a bird's-eye point of view, the valley is in reality broken up and dissected with innumerable mountain streams and gorges, so that you scarce find a straight level stretch of half-mile of road in any portion of it. Palampur is at an elevation of about 4000 feet, and from this elevation the mountains rise up almost perpendicularly in three well-defined gradations. The first, known as the 'lower range,' is well-wooded with fir, Himalayan oak, and rhododendron, and rises to about 7000 feet in elevation; immediately behind this the 'middle range' uplifts its gaunter steeps, sparsely forested with deodar, but more often disclosing bare slopes of grass, interspersed with patches of rock and precipitous cliffs. Its extreme elevation is about 10,000 feet. Sheer behind this uprears the 'upper range' to a height of 16,000 feet to 17,000 feet, its summit always white with everlasting snows. From down below in the valley, behind this upper range, you can catch glimpses of the enormous mountain-tops of the hinterland peeping up, whose crests are 18,000 feet to 20,000 feet above the level of the sea.

"The tea plantations begin at Dharmsala, and dot the narrow belt of land all the way from that station to Mundi territory. The majority of them are in the comparatively flatter strip at the base of the hill, but about a dozen lie on the sunny southern slopes of the lower range, and these are peculiarly isolated, and necessitate a good climb over execrable roads to reach them. They are picturesque beyond description; the

highest gardens, half buried in primeval forests, with their white bungalows and factories glittering like eyries high up on the hill-tops, bear themselves with an air of solitary aloofness from the world. In the lower strip of level land the system is quite different; for here many of the plantations (especially around Palampur) join each other, whilst the whole area is thickly sprinkled with the small two to ten acre tea-gardens belonging to native growers. The European estates number over fifty, and, according to the last published record, are inhabited by only twenty-seven European tea-planters, their wives and families—probably about fifty Europeans all told."

Africa.

The Nile Flood and Barometric Variations.—Captain H. G. Lyons, Director-General of the General Survey Department of Egypt, has been investigating the relation between the Nile Flood and the variations in atmospheric pressure in North-East Africa, and has communicated the more important of his results to the Royal Society of London. Captain Lyons finds that the curve of the Nile flood varies on the average inversely as the mean barometric pressure of the summer months, high and low pressures accompanying high and low floods respectively. The pressure variations are similar over wide areas from Beirut to Mauritius, and from Cairo to Hong Kong, and are generally of the Indian type of curve of the Lockyers, or Bigelow's "direct" type. Sometimes the pressure at Beirut and Cairo is in disagreement with that of the rest of the area, approaching the "Cordoba" type of pressure of the Lockyers or the "indirect" type of Bigelow. Considering monthly means of atmospheric pressure, this relation is more clearly shown, and pressure above or below the normal in the months of the rainy season in Abyssinia coincides closely with deficiency or excess of rainfall. From 1869-1903 an accurate prediction of the flood from month to month could have been made in six years out of seven. Using the conclusions derived from his investigation for the anticipation of the condition of the flood during the present year, Captain Lyons says:—"With weak summer rains and high-pressure conditions in September and the first part of October, no large amount of water can have been stored up in the soil of Abyssinia, so that the springs will run off early, and a very low stage may be expected in 1905."

Polar.

The Argentine Antarctic Station.—Mr. Mossman of this station arrived in this country towards the end of April, and gives this month some account of the voyage of the *Uruguay* from Scotia Bay, South Orkneys, to Buenos Ayres. The *Uruguay*, it will be remembered, is the vessel which relieved the Swedish Expedition. We give this month an illustration showing her lying in dock at Buenos Ayres.

It is announced that the Argentine Government has purchased the *Français* for the purpose of establishing additional meteorological stations

The *Uruguay* at Buenos Ayres.

at different points where Dr. Charcot's Expedition went into winter quarters.

Peary's New Arctic Expedition.—Commander Peary expects to start for the north in the early part of July, not March, as was stated by an error in our March issue (p. 157). It was expected that his new vessel would be launched on March 1, but this did not take place till March 23. On the following day the boat was christened the *Rooserelt*. In addition to this vessel, Commander Peary is chartering the sealer *Erick* to convey coals and stores to Greenland, and act as an

auxiliary vessel to the expedition. The *Roosevelt* is described as a "three-masted fore-and-aft schooner-rigged steamship with auxiliary sail power," and is similar in general design to a steam-whaler, but has specially rounded sides and bows to enable her to lift herself clear of the ice if nipped. Commander Peary hopes to establish a base camp in the far north, and to make a dash for the Pole in the spring of next year. He hopes to return to New York in the autumn of the same year.

New North Polar Expedition.—The Duc d'Orléans has organised a North Polar Expedition, which is to be under the Duc's personal leadership. For the purpose of the expedition the *Belgica*, the vessel of the recent Belgian Expedition, has been secured, together with the services of Lieutenant Gerlache, who is to command the ship. The object of the expedition is not to reach the Pole, and according to present arrangements the ship will not winter in the Arctic, though she will be provisioned for the event in case of being unexpectedly detained by the condition of the ice. The expedition left Sandefjord on May 6 for Bergen, whence it is to proceed direct to Spitzbergen, Greenland, and Shannon Island. At Shannon Island the Duc d'Orléans intends to visit the depôt of the Ziegler Expedition (cf. this *Magazine*, p. 157), and if he finds the members of that expedition there they are to return in the *Belgica*. The staff of the expedition includes some French men of science as well as a number of Norwegian sailors. All going well, the *Belgica* is expected to return in September.

General.

Problems of Earth-history.—Professor Frech is at present contributing to the *Geographische Zeitschrift* a series of articles on such of the more general conclusions or hypotheses of modern geology as have a direct bearing upon geography. One of these articles (xi. 2) is concerned with the history of climate in geological time, and contains much of great, if speculative, interest. Professor Frech points out that we are prone to believe that the present condition of things, hot tropical regions, and cold ice-capped poles, with temperate regions between, is the normal and necessary for our planet; whereas, in point of fact, the polar ice-caps are but remnants of the Ice Age from which we are just emerging. There is abundant evidence in geological time of eras when high latitudes had a warm equable climate, while at the same time there was no excessive heat at the Equator. Indeed, on the whole, the norm for the earth is probably a tolerably uniform temperature over the surface. Such equable temperature conditions certainly reigned throughout the greater part of the Primary epoch till the onset of a glacial epoch at the close. With the coming of glacial conditions in the Primary epoch there occurred a rapid evolution of animal and plant forms, till with the passing away of the cold at the dawn of the Secondary period we have the apparently sudden appearance of an entirely new fauna and flora. As the Secondary period waned there came a gradual lowering of temperature, with the development of

climatic zones, which, however, did not continue to the point when conditions become glacial. As before a rapid evolution of organisms took place, and again with the dawn of the new, the Tertiary epoch, the climate became warmer and again uniform. In the Tertiary period, as is well known, the temperature was certainly uniformly warm as far north as the fiftieth parallel and beyond. As the period went on there was a lowering of temperature, until the last, the great, Ice period, suddenly dawned.

As to the cause of these repeated climatic variations, Professor Frech adopts Arrhenius's suggestion that they are to be correlated with variations in the amount of carbonic acid in the atmosphere. The more carbonic acid the atmosphere contains the warmer it becomes, and, according to Arrhenius, a reduction of the present amount to one-half would produce a new ice-age between 40° and 60° lat. Now the amount of carbonic acid is increased notably by volcanic exhalations, while it is diminished by the building up of limestone by marine organism and by the formation of coal or peat by land plants. Therefore, according to our author, the periods of warm and uniform climate have been the periods of great volcanic activity, and these periods have been followed by a great fixation of carbon by plants and animals, which led to a lowering of temperature, and so we have the swing of the pendulum from periods of uniform climate to periods of well-marked zones. It is a geological commonplace that the Miocene period was at once a period of great volcanic activity, and a period of high temperature in high latitudes, and the author believes that the same is true of other geological periods when warmth reigned. Further, he believes that the great impetus to organic evolution in geological time has always come from climatic variations. With the swing of the pendulum from warm uniform climates to a sharp division of climatic zones and back again, great groups of plants and animals have died out, and new groups have arisen.

Oscillations of Shore-lines.—At a recent meeting of the Research Department of the Royal Geographical Society, Dr. Nansen read a paper on this subject, in which he said that opinions were greatly divided as to the nature and causes of variations in the shore-line of the Continents during geological ages. A widespread view was that the Continental coasts had even recently been subject to great oscillations of level—that at some places the coasts had been much elevated, whilst at others they had been depressed, and that they still remained at these different levels. He himself, however, believed that a thorough and systematic investigation of the problem would show this view to be incorrect; for there is much strong evidence that, though there has been great oscillations of level, the mean level of the Continental shore-lines has for long geological periods past been very nearly the same as to-day over vast regions of the earth. Dr. Nansen then proceeded to set forth the arguments in support of this conclusion. The coastal platforms and terraces formed by the so-called marine denudation—marine and atmospheric erosion combined—afforded, he stated, the best means of studying

the problem. In this connection he discussed the characteristics of the coast platform and Continental shelf lying off the Norwegian coast. The former, extending from Christiania to Finmarken and comprising the almost continuous belt of low islands and skerries that fringe the mainland, is situated between 100 feet below the present sea-level and 100 feet above it. Probably the platform was formed in glacial and inter-glacial times. The Continental shelf varies greatly in depth and width. At some places it is high and narrow, lying at a mean depth of from 200 feet to 300 feet, while at other points it is very broad and deep, lying from 700 feet to 900 feet below sea-level. Dr. Nansen adduced a number of reasons for concluding that, to a very great extent, this Continental shelf must be built up of rock and must actually have been cut back by erosion, though he recognised that the coastal deposition of Continental waste also played an important part in the building up of Continental shelves. Being largely cut in the solid rock, the Norwegian shelf could not have been developed at present sea-level, but must have been formed during periods of vertical oscillations of the shore-line. As in the case of the coast platform, the shelf would be cut to its lowest levels where the coastal rocks were comparatively soft, or where the marine denudation was most active. This investigation, coupled with the consideration of the conditions prevailing in other parts of the world, furnishes strong evidence that during recent geological periods the level of the shore-line along most Continental coasts had oscillated much below as well as above the present level. But, continued Dr. Nansen, it is a very important and striking fact that, in spite of these great oscillations, the shore-line along nearly all coasts is, at the present moment, very much at the same level as it has been during by far the greater part of recent geological periods. In fact, nearly one-half (42 per cent.) of the Continental surface of the earth stands between 600 feet above and 600 feet below the present sea-level. In Norway the coast platform was found to be situated very nearly at its original level, though in post-glacial times it had been depressed in places 700 feet below its present level, while in other places the depression had been very much less—only 30 feet to 60 feet. Consequently, in spite of this great difference in its depression, the coast had afterwards been elevated almost exactly to the level at which it stood before depression. This appeared to prove that the land, or crust, had a remarkable tendency, after disturbances of its level, to return to a certain mean position of equilibrium. In his opinion, the explanation in the case of Norway was that during the last glacial epoch the land had been pressed down by the weight of the ice-cap, and when this weight was removed the crust gradually reassumed its former level. While, however, he maintained that oscillations in the shore-level were thus due to movements of the earth's crust, he also thought that a survey of the available evidence indicated that the level of the ocean had, on the whole, risen somewhat during late geological times.

Oceanographical Research by the Prince of Monaco.—The Prince of Monaco opened his scientific campaign for the present year by

several short cruises during March and April with his yacht *Princess Alice* in the Mediterranean off Monaco, Mentone, Nice, and Corsica. The first of these was chiefly devoted to bathymetrical work in the vicinity of Mentone in relation to the exploration of the caves there (*cf.* this *Magazine*, xix. p. 281, and xxi. p. 43). The excavation of these caves, as already explained here, has yielded evidence of the alternate elevation and depression of the land surface, hence the need for a careful bathymetrical survey of the ocean in the neighbourhood.

The second cruise was devoted to a search for the larvæ of Velella in depths of 1000 fathoms, the larva being already known to exist down to 500 fathoms. Three other cruises were made for the purpose of obtaining high-level meteorological observations over the sea by means of kites and balloons. The balloons rose to a maximum height of 29,192 feet, where a temperature of −51·0° F. was recorded, and kite flights were made to 8528 ft., where it was 27·4° F. Besides the Prince's staff, including Captain Carr, Dr. Jules Richard, and Monsieur Sauerwein of the French Navy, there were on board during these various cruises Professor Boule of Paris, Professor Hergesell of Bonn, Dr. Volterick of the *Valdivia*, Mr. J. Y. Buchanan of the *Challenger*, and Mr. W. S. Bruce of the *Scotia*. The Prince as usual personally conducted the work.

The Voyage of the "Scotia."—An honour has been done to the *Scotia* by the Prince of Monaco, who has arranged that her name is to appear among the names of "illustrious oceanographical ships' which form the frieze round the top of the Oceanographical Museum at Monaco.

Progress is being made with the working out of the *Scotia* collections, which are remarkably rich. At a recent meeting of the Royal Society of Edinburgh, a paper was read by Sir Charles Elliot on the Nudibranchiata, containing descriptions of two new genera and four new species taken by the members of the expedition. In the *Proceedings of the Royal Physical Society*, Mr. T. V. Hodgson describes the five-limbed sea-spider (pycnogonid) taken by the party. It will be recollected that a five-limbed pycnogonid was one of the treasures taken by the staff of the *Discovery*. That taken by the *Scotia* (*Decalopoda australis*) proves to belong to another genus, and to have been previously described by an American naturalist so long ago as 1837. The point of interest is that, so far as is at present known, these five-limbed forms are confined to the Antarctic area.

Current Observations on the "Scotia."—During the whole voyage of the *Scotia* floats were thrown overboard daily, with an intimation printed in four languages requesting the finder to forward the missive to the British Admiralty stating the time and place where it was found. With the exception of two thrown over off the Argentine coast and recovered in a few days, which are therefore but of local interest, only one out of some thousand has as yet been picked up. This was thrown out on June 12, 1904, 355 miles N., 30° W. of Ascension (2° 46′ S., 17° 24′ W.), and was found at three miles east of the point of Custillo,

Honduras, on January 28, 1905. The float has therefore travelled a distance of 4250 nautical miles in 230 days, giving an average speed of 18·5 knots per diem. The Admiralty chart gives the speed of the current at the place where the float was thrown out as 4 to $1\frac{1}{4}$ knots; at Fernando Noronha, where the float must have passed, as 1 to 2 knots; and in the Caribbean Sea, on the western side of the Antilles, as $1\frac{1}{4}$ knots, these measurements being presumably knots per hour.

New British Marine Expedition.—An expedition has recently started with the object of thoroughly investigating the oceanography and biology of the region between India and Madagascar. The vessel employed is H.M.S. *Skylark*, under the command of Captain Boyd Somerville, who is accompanied by two civilian scientists, Mr. Stanley Gardiner and Mr. Forster Cooper, both of whom have already been engaged in scientific work in the area under investigation. The *Skylark* is to go first to the Chagos Archipelago, then to Mauritius, which it is expected will be reached about August 1. The voyage will then be continued *via* the Cargados reef to the Seychelles, whence the return will be made to Colombo, the starting-point. The scientists are to be left behind at the Seychelles, where they hope to spend some months in scientific work, returning home in January 1906.

NEW BOOKS.

EUROPE.

Memoirs of the Geological Survey, Scotland. The Geology of West Central Skye with Soay. Explanation of Sheet 70. By C. T. Clough, M.A., F.G.S., and Alfred Harker, M.A., F.R.S. 1904. Pp. 59.

This short memoir deals with a district exceedingly interesting from the point of view both of the geologist and the artist. It includes the Torridonian, Mesozoic, and Tertiary formations, among which latter the basalt plateaux and gabbro peaks are most conspicuous. It is well that the Geological Survey is now publishing these short descriptions of the ground that has been recently mapped, preparatory no doubt to a large monograph on the whole area. There are, however, many interesting regions such as the west of Sutherland whose geology has been mapped for some fifteen or twenty years, but which have not yet been geologically described even in a short memoir such as the one before us. It is time the department awoke to the desirability of carrying on its work a little more methodically, and of publishing a descriptive memoir on each district as soon as possible after its geological map appears.

Baedeker's Belgium and Holland. With 15 Maps and 30 Plans. Fourteenth edition. Revised and augmented. London: Dulau and Co., 1905. *Price* M. 6.

The new edition of this popular volume of Baedeker's series appears to have been carefully brought up to date. Several new maps have been added, and special information is given for the guidance of cyclists and motorists who contemplate exploring the charms of the "Low Countries," or the picturesque valleys of the Ardennes.

Pictorial and Descriptive Guide to Brighton and Hove. With 5 Maps and Plans, and 50 Illustrations. Fifth edition. Revised. London: Ward, Lock and Co., Limited. *Price* 1*s.*

A cheap and attractive Guide-book which supplies all the information required by the average visitor. It is well illustrated by numerous photographic views and several good maps.

A Handbook of Cyprus. Compiled by Sir J. T. Hutchinson, M.A., Chief Justice, and Claude Delaval Cobham, C.M.G., etc., Commissioner of Larnaca. Third issue, 1904. Pp. 112. With Maps. London: Waterlow and Sons, Limited. *Price* 2*s.* 6*d. net.*

This little volume combines all the features of a geographical compendium, a traveller's guide, and a commercial handbook and directory. The history, geology, agriculture, forests, antiquities, trade, administration, etc., are dealt with in carefully condensed summaries. There is a good large-scale map reduced from Kitchener's survey in 1885.

By the Ionian Sea: Notes of a Ramble in Southern Italy. By George Gissing. Map and Illustrations. Pp. 235. London: Chapman and Hall, Ltd., 1905.

It is pleasant in these cold spring days to escape for a little and saunter with Mr. Gissing through Southern Italy. No doubt a student of the Classics would appreciate his allusions more, but even for a mere man of science *By the Ionian Sea* is a very readable little volume wherewith to while away a dull afternoon. The author possessed the art of presenting a scene vividly to our inner eyes, and we find ourselves watching with him the peasant ploughing his field with the aid of a little donkey; we share the often rough fare at the village inns, or rejoice in the invigorating breezes of Catanzaro after the sufferings of Cotrone. The chemist's shop with its fine carving interests us, the people attract us, and finally we return reluctantly to a realisation of the keen north-easter blowing along our own pavements and say goodbye to Italy with regret.

The text is illustrated by a map and some figure sketches, presumably the work of the author.

ASIA.

Imperial Japan: The Country and Its People. By George William Knox. Illustrated. Pp. 288. London: George Newnes, Ltd., 1905.

A book on Japan is always welcome to our reading public, for which this Eastern counterpart of our Western Islands has an enduring charm. It is not only geographically that there is a curious resemblance between us: there are other points in common; their religious tolerance so unlike most Eastern countries, their bravery and loyalty; the samurai's code of honour—all these correspond to much in our own ideas. Whether it be correct or not to say that the West cannot understand the East we are not in a position to judge; Mr. Knox has done something towards helping us to that understanding, so far as that is possible without personal experience of the country and its inhabitants. He gives us an interesting account of the personal and social life and customs, and here the contrast between East and West is brought home to us sharply enough. The public life of a Japanese gentleman offers much that is worthy of our emulation, but in his home life, and especially in his relations to his women, there

exists a radical difference which is only beginning to yield to foreign influence. Apart from this Mr. Knox leaves us with a feeling of increased respect for the Japanese as a nation.

The illustrations are excellent.

AFRICA.

Guide-Annuaire de Madagascar et Dépendances, Année 1905. Pp. 858. Tananarive: Imprimerie Officielle.

This Year-book for Madagascar is issued by the French Government for the use of colonists, planters, merchants, officials and travellers. It is in two sections. The first comprises a calendar and a directory of military, naval, and civil officials; then follows a complete geographical account of each of the various provinces, treating of their physical features, population, agriculture, commerce, industry, etc., each province being illustrated with a special map. The second section is composed of special notices and monographs dealing with general geography, ethnography, meteorology, geology, forests, public works, roads and railways, trade, colonisation, etc. Altogether the handbook is most complete and exhaustive, and may be considered the standard official reference book for all information about Madagascar.

POLAR.

The Norwegian North Polar Expedition, 1893-96. *Scientific Results.* Edited by Fridtjof Nansen. Volume IV. Published by the Fridtjof Nansen Fund for the Advancement of Science, 1904.

The fourth volume of the scientific results of Dr. F. Nansen's expedition in the *Fram* contains three papers. The first is on the "Diatomaceae from the Ice-floes and Plankton of the Arctic Ocean," by H. H. Gran. Contrary to what was expected, the algae flora of the Polar Sea was found to be very poor indeed. In seventeen samples examined by Dr. Gran diatoms were found in only seven, and then in comparatively small numbers. The specimens taken from ice-floes were, however, more numerous and of greater interest. While these forms do not appear in the plankton of the Polar Sea it is remarkable that many of them are found along the Arctic shores of Asia and East Greenland. Dr. Gran deals with the bearing of the distribution of these diatoms upon the general drift of Polar ice, and while cautiously avoiding too general conclusions until further evidence is forthcoming, shows that the composition of the samples before him strengthens the belief of Nansen that the floes of North Siberia and East Greenland have some connection with each other. The paper ends with some extracts from the diary of Dr. Blessing, the surgeon of the expedition, who collected most of the samples.

The second paper in the volume is by Johan Kiaer, is entitled "The Lower Silurian at Khabarova," and deals with several brachiopods and trilobites found in those strata.

The last paper is by Fridtjof Nansen on the "Bathymetrical Features of the North Polar Basin," with a discussion on the origin and formation of continental shelves and previous oscillations of the shore-line. This is a very important paper, dealing as it does with the most striking discoveries of the Norwegian North Polar Expedition. In his introduction Dr. Nansen describes the improvised sounding wire which was manufactured on board by untwisting wire cables and soldering the pieces together to obtain a line of sufficient length. It must have

been a difficult piece of work, and the finished wire demanded careful handling, but it seems to show a singular lack of foresight to equip such a ship without adequate sounding-gear, and as a result a large number of the soundings did not reach bottom. The expedition proved the existence of a deep polar sea, over 2000 fathoms in places, and practically eliminated any chance of there being any extensive new land to the north of the New Siberian Island or much north of Greenland. The polar sea has been shown to be in the form of a deep basin cut off from the Norwegian Sea by a narrow submarine ridge running from Spitzbergen to North Greenland. This deep basin is apparently bounded on all sides by an immense submarine shelf, seldom more than 100 fathoms below the surface, running northward from Europe, Asia, and probably America, to latitudes of from 75° N. to over 80° N.

From this continental shelf arise Spitzbergen, Franz Josef Land, Novaia Zemlia, the New Siberian Island, Wrangel Island, and several other Arctic islands. Davis Strait with Baffin Bay and the Norwegian Sea, Dr. Nansen compares to great fjords running into this plateau, each, after the manner of fjords, separated from the ocean outside by "bars" or submarine ridges, viz., one from Baffin Land across Davis Strait to Greenland, and the other from Greenland to Iceland and across by the Faroes to Shetland. The boundary of this continental shelf on the American side of the Pole is almost purely hypothetical as yet, but from what is known Dr. Nansen believes that the deep Polar Sea begins not far beyond the northernmost sounding north of Alaska. To the north of the American Arctic Archipelago our knowledge is even more vague, despite the recent discoveries of Sverdrup; "whether new lands may exist further north it is difficult to say: we do not even know whether the sea is deep or shallow, north of these northern coasts."

The paper treats at length of the origin and formation of continental shelves, with special references to those of Norway, Greenland, Iceland, and the Faroes. The author concludes that where sedimentation has been rapid this has been the chief mode of formation, for in those cases the waves will probably have expended a great deal of their energy before reaching the coast. On the other hand, broad shelves occasionally occur where excessive sedimentation is hardly probable. These must be due to the joint action of subærial erosion and marine denudation.

The volume is copiously illustrated with maps; but it is to be regretted that several are so much reduced as to be almost unreadable, and it is unfortunate that so unpleasing a colour scheme should have been chosen for others.

GENERAL.

Landscape in History and other Essays. By Sir Archibald Geikie, D.C.L., F.R.S. London: Macmillan and Co., 1905.

Under this title Sir Archibald Geikie has reprinted ten essays and addresses written between 1887 and 1904 on a variety of subjects, which are treated of in the characteristic charming style of one who, for more than a generation, has been distinguished as perhaps the most graceful of British scientific writers. One of the best of Sir Archibald's chapters is perhaps his admirable "appreciation" of Hugh Miller, an address delivered at the centenary of Miller's birth celebrated at Cromarty in 1902. Sir Archibald is, he says (p. 281), "probably the only geologist now alive who knew Hugh Miller well. He was my earliest scientific friend. Some boyish articles I had written in an Edinburgh newspaper on a geological excursion to the Isle of Arran had gained me his acquaintance, and

ever thereafter I enjoyed his friendship and profited by his encouragement. To his helpful intervention I owed my introduction to Murchison and thence my entry into the Geological Survey." The author no doubt also owes something as a writer to Hugh Miller's literary style, and it is pleasant to note, after half a century has rolled past and a new generation has arisen, how the influence of that great Scotsman still survives, and although most of his purely scientific work has been superseded, how his footprints still remain visible on the shifting sands of time.

Another excellent paper forms the subject of Chapter IX., "Science in Education," an address to the students of Mason University College, Birmingham, 1898. The author, although a scientist and a specialist, shows that his scientific work has not narrowed his mind or diminished his sympathy with general literary culture. Indeed, in this address to the science students of Birmingham (p. 286) he goes so far as to express the opinion that "a training in science and scientific methods, admirable as it is in so many ways, fails to supply those humanising influences which the older learning can so well impart. For the moral stimulus that comes from an association with all that is noblest and best in the literatures of the past, for the culture and taste that spring from prolonged contact with the highest models of literary expression, for the widening of our sympathies and the vivifying of our imagination by the study of history and philosophy, the teaching of science has no proper equivalents. . . . Be assured that in your future career, whatever it may be, you will find in literature a source of solace and refreshment, of strength and encouragement, such as no department of science can give you." And again: "Men who have been too exclusively trained in science, or are too much absorbed in its pursuit, are not always the most agreeable members of society." Many readers will entirely agree with this last observation. The part of the book relating to scenery and landscape, although interesting, is not exactly new, and occupies less than half of the pages. The title is thus a little misleading, as the book is mainly a collection of miscellaneous papers, reprinted in succession to the *Geological Sketches* which appeared some twenty-four years ago from Sir Archibald Geikie's most industrious and fluent pen.

The Other Side of the Lantern. By Sir Frederick Treves, Bart. London: Cassell and Co., Ltd., 1905.

This fascinating book is appropriately dedicated to the King, for it is mainly concerned with our own possessions, our allies, and our friends. The author calls it an account of a commonplace tour round the world; but though many are yearly undertaking similar journeys, few bring to the task of observation such a quick eye or such ready sympathy.

There is indeed a touch of poetry and of imagination in the description of the widening estuary of the Thames, of the Suez Canal and the long strip of desert, of the dead cities of India—Fatehpur, Sikri, Amber, and Chittor, of the old grey line that begins at Simla and ends with the horizon, one of the primeval highways of the world—the way from Asia into India, of the plain little yard in the glorious palace at Agra where the Great Mogul crept aside to pray, and of the Chinese mother and the wandered child. The writer leaves deep in our minds the impression which he himself formed of India, a land of crowds, of colour, and of melancholy; of the Burmese women who own no allegiance to the tyranny of fashion, and whom he calls the Ladies of Creation; and of the "nightmare city" of Canton with its two millions of to us strange and mysterious inhabitants.

But perhaps just at the present moment the most instructive part of the book

is that which concerns Japan. It is good for our British sense of self-satisfaction to read what the skilful surgeon with his trained intelligence has to tell us about the practical nature of the Japanese Red Cross Society and the Japanese Army Medical Corps, to whose joint efforts it is due that during six months of terrible fighting and exposure in a foreign country there was only a fraction of one per cent. of loss from preventible disease.

The Statesman's Year-Book: Statistical and Historical Annual of the States of the World for the Year 1905. Edited by J. Scott Keltie, LL.D., with the assistance of I. P. A. Renwick, M.A., LL.B. Forty-second Annual Publication. London: Macmillan and Co., 1905.

This invaluable publication has been revised to date, and exhibits all the usual features with certain minor modifications and improvements. The maps and diagrams are of great interest, and among them we may specially mention a map of the cotton areas of the world, which in essentials is the same as that which has already appeared in this *Magazine* (vol. xx. p. 334), one on the wheat-growing areas of the world, and one showing the regions from which meat is imported into Britain. Another map illustrates new railway schemes in the Near East, and in the same connection we may notice that the section of Turkey relating to the Bagdad Railway has been brought up to date.

L'Année Coloniale. Publiée sous la direction de MM. Ch. Mourey et Louis Brunel en collaboration avec M. Chemin Dupontès. Quatrième Année (1902-1903). Paris: Chevalier et Rivière, 1905. *Prix* 4 *fr.*

This little annual appears somewhat tardily, for in the present issue we have an account of the eruption at Martinique in April 1902, and its statistics are not very full, especially in the case of the smaller colonies; but it gives in convenient form and small bulk a précis of the notable political and economic facts for each of the French colonies during the period indicated. There is no index, but a fairly full table of contents. Each colony is treated separately, and there is no general chapter, but two tables at the end summarise the facts in regard to the commerce of the different colonies.

Geographen-Kalendar. Herausgegeben von Dr. Hermann Haack. Dritter Jahrgang, 1905-1906. Gotha: Justus Perthes, 1905. Pp. 468. *Price* M. 3.

Dr. Haack's geographical annual has now fairly established itself as a reference book, almost indispensable to all special students of geography. The plan of the work is the same as in previous years. The Calendar is for 1905-1906, and the Address-book is revised to date, whilst the Geographical Events of 1904, the Geographical Literature of 1904, and the Obituary Notices for 1904, are all specially written for this issue. The sixteen supplementary maps illustrate new frontiers, new railways, and other cartographical changes during the past year. An admirable portrait of Elisée Reclus, the distinguished French geographer, forms an appropriate frontispiece.

Meteorologia Generale. Di Luigi de Marchi, 2ª edizione rifatta e ampliata con 13 figure intercalate nel testo e 6 tavole. Milano: Ulrico Hoepli, 1903. *Price* L1.50.

This is one of the Hoepli manuals, and like the other members of the series is not only very cheap but exceedingly well got up. It is a new edition of a book

originally published sixteen years ago, but, as the author remarks in his preface, these sixteen years have produced such radical changes in the science of meteorology as almost to necessitate re-writing. The book covers a large amount of ground, and is necessarily, on account of the limits of space, condensed in style, but its clear figures and simple maps should greatly aid the reader in his task. It aims at giving a concise account of meteorology and its position among the natural sciences, and this aim appears to be admirably carried out.

A somewhat curious point is that, although the book has been some time in our possession, yet the author's preface bears date June 1, 1905.

"*Round the World*"—A Series of Geographical Readers. Edited by T. Cartwright, B.A., B.Sc.

Tales of Travel. By Chas. F. Hayward. *Price* 10*d.*
Land and Water. By „ *Price* 1*s.*
Our English Home. By C. W. Crook, B.A., and W. H. Weston, B.A. *Price* 1*s.* 3*d.*
The British Isles. By C. W. Crook, B.A., and W. H. Weston, B.A. *Price* 1*s.* 4*d.*
Europe. By W. Vere Mingard. *Price* 1*s.* 6*d.*
Our Colonial Cousins.
Asia. By James Wallis, B.A. „
Africa. By C. M. Bailey, M.A. „
America. By John Kelly. „
Australasia. By G. L. Glover, B.A. „
The World. *Price* 1*s.* 8*d.*
London and Edinburgh: T. C. and E. C. Jack. 1905.

This new series of Geographical Readers is worthy of special commendation. The characteristic features of the various countries are summarised in simple, graphic language, and a living interest is added to the general descriptions by quotations from the original works of travellers and explorers. At the end of each volume a summary of the leading geographical facts ensures a systematic grasp of the whole subject after the general features have been impressed on the student's mind. The illustrations in black and colour are effective and well selected, and so well up-to-date that even Sir Frank Younghusband's latest view of Lhasa is given. There are also numerous maps showing surface relief and political divisions.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

In Unknown Africa: A Narrative of Twenty Months' Travel and Sport in Unknown Lands and among New Tribes. By Major P. H. G. Powell-Cotton, F.R.G.S., F.Z.S. Medium 8vo. Pp. xv + 619. *Price* 12*s.* 6*d. net.* London: Hurst and Blackett, 1905.

Canada As It Is. By John Foster Fraser. Crown 8vo. Pp. 312. *Price* 6*s. net.* London: Cassell and Co., 1905.

Une Année de Politique Extérieure. Par René Moulin. Préface de M. Jules Godin. Pp. vii + 353. Paris: Plon-Nourrit et Cie., 1905.

Konstantinopel und das Westliche Kleinasien. Handbuch für Reisende, von Karl Baedeker. Mit 9 Karten, 29 Plänen und 5 Grundrissen. Pp. xxiv + 275. *Preis* 6*m.* Leipzig: Karl Baedeker, 1905.

Grison's Oberland Illustrated. Art. Institut Orell Füsseli. Zürich, 1905.

Rifle and Romance in the Indian Jungle: A Record of Thirteen Years. By Captain A. J. R. Glasfurd. Demy 8vo. Pp. viii + 404. *Price* 16*s. net.* London: John Lane, 1905.

Greece: Handbook for Travellers. By Karl Baedeker. Pp. cxxxiv + 434. *Price* 8*m.* Leipzig: Karl Baedeker, 1905.

Le Régime Foncier aux Colonies. Tome vi. Institut Colonial International. Bruxelles, 1905.

Guide-Annuaire de Madagascar, 1905. Imprimerie Officielle. Tananarive, 1905.

L'Année Coloniale. Publiée sous la Direction de MM. Ch. Mourey et Louis Brunel. Quatrième Année, 1902-1903. Pp. 339. *Prix* 4*fr.* Paris: Chevalier et Rivière, 1905.

Illustrations of the Botany of Captain Cook's Voyage Round the World in H.M.S. Endeavour in 1768-71. By the Right Hon. Sir Joseph Banks, Bart., K.B., P.R.S., and Dr. Daniel Solander, F.R.S., with Determinations by James Brittens, F.L.S., Senior Assistant, Department of Botany, British Museum. In three Parts. Parts I. and II., Australian Plants. Pp., text, 102; Plates, 318. Printed by order of the Trustees of the British Museum. London, 1905.

Guide to the Gallery of Birds in the Department of Zoology of the British Museum (Natural History). With 24 Plates and 7 Illustrations. Pp. vi + 228. Printed by order of the Trustees, British Museum. London, 1905.

A Guide to the Fossil Mammals and Birds in the Department of Geology and Palæontology in the British Museum (Natural History). With 6 Plates and 88 text-figures. 8th Edition. Pp. xvi + 100. British Museum, London, 1905.

The Norwegian North Polar Expedition, 1893-1896. *Scientific Results.* Edited by Fridtjof Nansen. Vol. VI. Pp. xv + 659. Published by the Fridtjof Nansen Fund for the Advancement of Science. Christiana, 1905.

Also the following Reports, etc.:—

Report on the Administration of the Province of Assam for the Year 1903-1904. Shillong, 1905.

Report on the Administration of the Madras Presidency during the Year 1903-1904. Madras, 1904.

Memoirs of the Geological Survey of New South Wales: A Monograph of the Silurian and Devonian Corals of New South Wales. Sydney, 1905.

From Scotland to Norway, Denmark, and Germany. Illustrated Guide. Published by the Leith, Hull, and Hamburg Steam Packet Co. Leith, 1905.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

RECENT CHANGES IN THE CRATER OF STROMBOLI.[1]

By Tempest Anderson, M.D., D.Sc.

(*With Illustrations.*)

Stromboli is the most easterly and northerly of the Lipari Islands. It is situated north of Sicily, close to the track of steamers plying between Naples and the Straits of Messina, and is thus an object familiar to passengers to or from Egypt or the East, though comparatively few have landed on its shores. Its almost constant eruptions have gained it the name of the lighthouse of the Mediterranean. It is almost circular, as its old name Strongyle indicates, and rises as an irregular cone out of deep water. On the NW. side are the crater, and the Sciara or steep slope down which the ejecta roll into the sea.

The summit of the mountain, which is about 3000 feet high, consists of a crescentic ridge, the Serra di Vancori, open towards the north. It forms part of an old crater ring, and thus presents points of similarity to Somma. Inside the crescentic ridge, and in places joined to it by irregular crests of rock, but mainly separated from it by a valley, "A Fossieiedda," similar to the Atrio del Cavallo of Vesuvius, is another crescentic ridge, connected with the two extremities of which, and immediately overlooking the sides of the crater, are two conspicuous pointed rocks, the Torrelle, which partly obstruct the view of the crater when viewed from the cliffs overlooking the Sciara on its NE. and SW. respectively. These Torrelle, being practically unaltered by ordinary eruptions, present good points of comparison for estimating the changes that take place. Between the two Torrelle, in the midst of a sort of

[1] Abridged from a Paper in the *Geographical Journal* for Feb. 1905.

amphitheatre formed by them and the crescentic ridge last mentioned, are the crater and its appurtenances, the "Apparato Eruttivo" of Italian observers. This amphitheatre is open to the NW., and from its open side beyond the craters the steep slope of the Sciara extends down into the sea. This slope is bounded on each side by two steep cliffs, Filo di Sciara and Filo di Barcuna, which are formed, like the Sciara itself, of lava-streams, agglomerates, and dykes; in fact, of almost every kind of compact volcanic material, chiefly of basic composition.

This Sciara, as is well known, is one of the most peculiar features of this volcano. It extends at an angle of about 35°, which is the "angle of repose" for the kind of material of which it is composed, down into the deep water of the Mediterranean; and though the volcano has certainly been in almost constant eruption during the whole of the historic period, and probably much longer, it has never been able to build up a talus sufficient to rise to the level of the sea, much less to that of the lip of the crater, about which, according to the analogy of other volcanoes, it might have been expected to have built up a cone on this side comparable to the portion on the south described above. The illustration, "The Sciara from the NE.," from a photograph taken by the author in 1888 from the ridge overlooking the NE. side of the Sciara, and consequently looking SW., shows the Sciara extending down to the right of the picture with the Filo di Barcuna behind it. The pointed rock to the left of the picture is the eastern Torrella, with a gap to the left of it through which the ejecta are thrown during the larger eruptions, and roll on to the steep slopes in front and down the Sciara into the sea. The western Torrella is just visible in the distance beyond the eastern Torrella. The crater situated between the two was in 1888 a large pit obviously formed by severe explosions. It contained two small secondary cones. One, towards its western part, and close to the edge of the Sciara, was that from which the explosive eruptions took place several times an hour; the other, towards the eastern part, emitted only smoke.

In 1904, when the author took comparison photographs from nearly the same spot, this large crater was almost entirely filled up, and the slope of the Sciara was continued upwards, so that the cone of ejecta overtopped and was visible behind the eastern Torrella. The activity in this eastern part of the crater still maintained the same quiet character as in 1888. The whole area constantly emitted vapour; there was more than one bocca visible, but they were quite small, and only gave very feeble explosions, and these with a rhythm quite independent of those at the western part of the crater.

The illustration, "Stromboli. An Explosion. Early Stage," taken by the author on April 20, 1904, from a point to the west of the crater, and consequently in almost exactly an opposite direction to that showing the Sciara from the NE., shows the condition of the western part of the crater sixteen years later. The conspicuous rock to the right of the plate is the western Torrella, behind which, in 1888, was the great crater above referred to. The bocca to the left, from which the explosion is taking place, is shown in some of the earlier photographs as situated on the edge of the larger crater at its junction with the Sciara. The great

Tempest Anderson, photo. *Swan Electric Engraving Co*

STROMBOLI: THE SCIARA FROM THE NORTH-EAST. 1888.

Tempest Anderson, photo. *Swan Electric Engraving Co.*

STROMBOLI: AN EXPLOSION. EARLY STAGE.

crater is now seen to be filled up by ejecta which prolong the slope of the Sciara upwards over what was previously its site, while the bocca itself remains in all probability really in its former position, though apparently on the slope of the Sciara instead of on its edge.

It will be interesting to future visitors to see whether the volcano will continue to prolong the slope of the Sciara much further upwards, or whether a paroxysmal explosion will occur which will clear the great crater again.

IN THE LIPARI ISLANDS.[1]

By George Yeld, Editor of the *Alpine Journal.*

On April 14, 1904, Dr. Tempest Anderson and I, in company with Dr. Cool and Herr Philip, arrived at Milazzo, the ancient Mylæ, a little town at the southern end of the promontory of the same name in the NE. of Sicily. We drove to the Albergo Genova, where we afterwards spent the night. Half-a-dozen street arabs pertinaciously thrust their services upon us as luggage-carriers, and amused us much at small expense. The same evening we visited the castle on the hill to the north. On the western side of the promontory, much of which was covered with olive yards, was a charming little bay: in one or two places where a gap in the cliffs was less steep a stream of olives, so to speak, flowed down to the shore. The smoke of Stromboli was visible over not quite the highest point of the olive yards. But the great feature of the view was Etna—vast, even overwhelming in size. The parasitic cones on the W., or probably SW., ridge of it to Anderson's educated eye spoke volumes, but to me the glimpses of torrent beds and little towns perched on steep hills were more eloquent. The sunset was glorious.

The next morning on the most peaceful of seas and an ancient mail-boat we crossed the Lipari. On the east side of the Milazzo promontory the olives came down to the very edge of the shore. We noticed a line of caves just above the present water-line—perhaps six feet above it—which would mean, so Anderson explained to me, that the land had risen—in the same way that at Pozzuoli the land has gone down and risen again in historic times. Etna was still the great feature of our view.

At Lipari we put up at the Hotel Traina, where Signor Traina did his best for us. The house is, like the other houses in Lipari, flat-roofed, and by climbing a ladder it was possible to reach a higher roof, from which one could see the little bay. The accommodation was, of course, somewhat primitive, but we were fairly comfortable. We spent the rest of the day in a visit to San Calogero and its hot springs on the west side of the island, the town of Lipari being on the east coast.

On the way back we left the main track, and turning to the right after covering some little distance gained a most lovely view of the wastes of Vulcano. In the narrowest part of the path I met a small cow in charge of a little child, who endeavoured to secure the mastery by means of a rope, but the cow acted as leading guide; the child had

[1] Reprinted from the *Alpine Journal* for May 1905.

even less to say as to the route taken than the feeblest traveller that ever climbed the Breithorn. Whilst in search of flowers I lost the rest of our party, and returned alone through some of the deepest chasms that we came across. The soil is friable, and the rains wash it away easily, so that many of the paths are like deep ditches.

On the next day, April 16, Dr. Anderson and Herren Cool and Philip, with Francesco Conti, an English-speaking native whom we had engaged as servant, and who made himself exceedingly useful, went to Filicudi. I went with them as far as Malfa, in the island of Salina. I ought to have explained that, thanks to the good offices of Dr. Linden of the Zoological Station at Naples, we had engaged a small steamer of about sixty tons, the property of S. Gaetano Saltalamacchia, of Lipari, so that we could go where we liked when we liked, unless Æolus had forgotten to turn the key on his riotous gang of winds, as was once or twice the case.

When we had rounded a little cape we caught sight of the small white town of Canneto, behind which is a mountain of pumice stone. This is the only place in the world, I believe, where pumice stone can be got without grit (or anything that will scratch) in it, and practically Canneto furnishes the world with pumice stone. A little further we saw the Campo Bianco and Roccie Rossi. The Montagna delle Pauvre in Salina then showed his fine broad wedge.

At Malfa, where the footing, though steep, was less uncertain than on the little steamer, I had the good fortune to meet with S. Joseph Bongiorno, who had lived some years in Melbourne and spoke English perfectly.

Before I met with him I had been for a delightful walk on the hill-side above Malfa, and had noticed that the children seemed better cared for and more intelligent than those of Lipari. Signor Bongiorno, who is a very keen educationist, explained to me their educational system. The children—there were then eighty-four boys and seventy-five girls under instruction—remain at school from the age of six till they get a leaving certificate. I learned much, too, of the fruits and flowers of Salina; amongst the former are figs, almonds, peaches, nectarines, apricots, different sorts of apples and pears, very fine cherries, blackberries, and *nespoli*. The vines have suffered severely from phylloxera, and consequently the once flourishing trade in wine, especially Malvasia, has been sadly reduced. I returned to Lipari by the mail-boat. In the evening our party at the Traina was increased by a professor from Belgrade and a painter from Geneva.

On the 17th the rest of the party went to Panaria, leaving me behind in Lipari. The sea was so rough that they were not able to land at the usual spot, though they managed to do so in another place with considerable difficulty. I spent the day wandering about the hills.

On the 18th we all went to Stromboli in the little steamer. We inspected Panaria and Basiluzzo at close quarters, and saw a small fleet of boats engaged in collecting sponges. Just as we got close to the shores of Stromboli a most curious gale assaulted us; it seemed to blow the fine spray over us from all sides at the same time. I do not think

it lasted more than five or ten minutes. We passed close by the Sciara, and saw many big stones engaged in free gymnastics. "They was very big large stones; they jump in water very much high."

When we had rounded the semaphore our captain said that it was too rough to land at the usual place, and that the steamer's own boat was too small for safety in such a sea. So he proceeded to invite the natives to send out a boat to us by whistling for all the steamer was worth. By and by, in response to this deafening appeal, a boat came out. I found a place in the bottom of it, and, as my head was just level with the water, I was able to appreciate properly the size of the waves. The boatmen, assisted by our servant, Francesco Conti, who thoroughly understands boats himself, landed us very cleverly. They waited for a big wave and rode shorewards upon it; then the people on the beach lent a hand, and we got ashore with nothing worse than a slight wetting.

Of our doings on Stromboli I need say little, as Dr. Anderson's paper is devoted to that famous volcano. We found accommodation at the house of Don Francesco Renda, to whom our best thanks are due. We made two ascents of Stromboli. On the first in splendid weather we saw everything to perfection, and the mountain was kind enough to give a special matinée, so to speak, for our satisfaction.

We began the ascent through vineyards where the vines were trained on low trellises and fenced with reeds to protect them from the wind-driven sand. Higher up there were some olives, which seemed to spread themselves out flatly to catch as much sun as possible and avoid the winds as well as they could. Higher still we found capers and willows growing in shifting volcanic dust; the latter provided the tying material for fastening the vines to the trellises. After passing through a paradise of cistus we reached in about an hour and three-quarters from the start the first of a number of big ridges of red rock (lava and tuffs, my companion said) and saw the sea off the NE. coast of the island. We of course halted to study the Sciara. The volcano itself with its scarred rocks, black volcanic dust-exuding sulphur, and many fumaroles and periodic explosions, suggested mine and breach and the brazen throat of war; but turn your head and you have vineyards, white houses, a sapphire sea, and Strombolicchio like Neptune's trident rising from the waves. We saw a fine hawk, a barking crow, many swallows, and several butterflies on our way up. We did not see any quails, though they are caught at this season, but this year so far only two had been netted.

Leaving the apparent top we walked down a ridge to the Ginostra side of the mountain. Thence we witnessed many terrific eruptions, huge stones visibly red-hot being hurled high into the air. Many took a *salto mortale* down the Sciara and added to that huge mass which stretches for thousands of feet into the depths of the sea, so that were the waters to dry up and show Stromboli in the fulness of his stature we should gaze in wonder on a masterpiece of flamboyant architecture.[1]

On our second ascent rain began to fall quite early in the climb, and

[1] *Cf.* Sir Martin Conway, *The Alps*, p. 282.

long before we reached the top thick mist prevented us from seeing more than a few yards. Near the top the mist lifted slightly, and I found some rocks near a shelter hut used by signallers, on which on a sunny day I fancy one might have scrambled about with satisfaction. The bad weather was a great disappointment, as it prevented Anderson from photographing various details of the mountain—the object of our second ascent.

But it was obviously useless to wait; the wind blew, the rain drove in our faces, the mountain seemed to swear at us. I have some recollection that the compliment was returned. In brief we departed *re infecta*.

On the 23rd we returned to Lipari by the mail boat *Toscana*, our own little steamer having left us on the 20th with Herren Cool and Philip on board. The captain very politely, at Anderson's request, took us round the north side of the island, so that we again saw the Sciara. We landed at Canneto and had a pleasant walk to Lipari.

We spent our last day in a visit to Vulcano and Vulcanello. Conti found us a boat. With Conti and the two boatmen we made a party of five, and were attended by three dogs. The sea was calm, and we had a very pleasant row. A boat from Vulcano passed us, laden with dried broom for the ovens of Lipari. The shore scenery of Lipari varied much. We passed a curious half-cleft rock, called, from its appearance, "The Scissors." Here there were great cliffs, here a fine cirque with vines coming down to the shore. At the Fossa del Capistello Conti landed to secure certain specimens of rock. Two fishermen's sailing-boats in the distance after we had passed the end of Lipari looked exactly like a couple of sea-gulls.

The colouring of Vulcanello was a striking red, as if the mountain were still red-hot. We turned into the Porto di Levante and landed near the Faraglione not far from the house at which our friend S. Narlian so hospitably entertained Dr. Anderson on his previous visit to Vulcano in 1888. The mountain Vulcano looked an absolute desolation—furrowed, scarred, ruined. Five or six fumaroles, one larger than the rest, were smoking. At the foot of the mountain was a great thicket of broom, richly coloured and richly scented. When walking through it, if you shut your eyes, you might have imagined yourself in an English clover field in full bloom, so similar was the fragrance. The path mounted rapidly; in parts it seemed to be cut in almost solid sulphur. The crater of Vulcano I can only compare to a deep dried-up brick-pond. But it was very interesting, especially as Anderson replied at once to all my questions as to fumaroles, bombs, and the other details of a volcano's outfit.

After visiting the highest point of the mountain Dr. Anderson and Conti returned the same way, with a view to further examination of certain fumaroles, whilst I chose a direct route for myself. It was steep but much shorter, and, like most volcanic climbing, very destructive to one's boots.

We then, after a visit to the Villa Narlian, where we were very hospitably received, went on to Vulcanello, the boat having been sent round to await us. We thoroughly examined the crater and then

descended to the sea; the cliff just above the water gave us a little scramble before we reached our boat. The old rocks on Vulcanello were red, the newer ones dark-coloured. Then we returned to Lipari after a most enjoyable day. It is true that there was a slight haze, but the cool air, the warm sun, the clear blue sea, the wondrous red of the volcanic rocks, and the fervid gold of the richly-scented broom thickets compose a memory, now rendered all the more vivid, as I write, by the rigours of an Arctic April in England.

It will have been clear from what I have said that we found little climbing in the Liparis, but nevertheless our holiday was exceedingly pleasant. In one respect these islands recall one of the greatest delights of the Alps. They are rich in flowers. Cistuses, white and purple, brooms in several varieties, a fine orchis or two, the red gladiolus in the corn (in Lipari), *Iris Sisyrinchium*—in one place in Lipari I counted forty blossoms together—occur to me at once. *Arundo donax* (the giant reed), opuntias and yellow euphorbias (I fancy the native name is "frasca") were almost everywhere to be seen. My friend at Malfa spoke also of jonquils and narcissi as growing wild, and on Vulcanello there were large numbers of pancratium, which I take to be Tennyson's "milky-belled amaryllis." In the garden of the villa on Vulcano were oleanders, mignonette, rosemary, ivy-leaved pelargoniums, verbenas, heliotrope, and wistarias; nor do these exhaust the list. But for me personally the broom will always be *the* flower of the Liparis. I ought, perhaps, to mention that there was a fine date palm in Don Francesco Renda's garden, bearing fruit—and good fruit too, *experto credite*.

But I must not forget to point out the special charm of these scrambles in the Liparis. The mountains rise out of the sea, and what the green alp is to the great alpine peak the blue sea is to Stromboli and his fellows. To-day the winds are busy, the dark purple waters are rough, and the angry surges are heavily crested with foam. To-morrow the sunbeams will sleep on the waveless blue and but the slightest fringe of white be seen on the black volcanic sand of the shore. But, look what way you will, your eyes will fall upon the sea, and when memory hereafter calls up recollections of the Liparis the sea will be the setting of every picture! And such a sea! The peacock's neck—the opal, and emerald, and sapphire—the bluest of radiant flowers—the sumptuous purple of wine have all been used in comparisons to indicate its glorious colouring; yet after all the Mediterranean, like sunrise on the Alps, cannot be described in words; it must be seen to be appreciated.

And in yet one other respect the Liparis will bear comparison with —nay, exceed—the Alps—in the human interest. "A very dull person," as Sir Martin Conway observes[1] when insisting on this feature of the Alps, "looks interesting when beheld down a vista of several centuries." What then shall we say of the Phœnicians, Greeks, Carthaginians, not to mention Æolus, Deiopea, Calypso, whose shadowy forms haunt the Sicilian waves, the fairest part of the Mid Sea, that, as George Eliot has finely said, "moans with memories"? I wonder, by the way, whether

[1] *The Alps*, p. 257.

Juno was as good as her word and Æolus gained the promised Deiopea. If so, no doubt Vulcano and Stromboli gave a special pyrotechnic display at the nuptials.

SCOTTISH PLACE-NAMES AND SCOTTISH SAINTS.

By Ralph Richardson.

Among the many provinces of geography, that of the etymology of place-names is one of the most fascinating and the most difficult. While the ancient inhabitants of Scotland often followed the admirable practice of naming a place after its natural features, they occasionally named it after a favourite saint. It is surprising how many Scottish place-names thus originated. Appended to this paper is a by no means complete list of Scottish place-names derived from the multitude of Scottish saints who appear to have flourished from the beginning of the fifth to the beginning of the twelfth century.

In the preparation of this list reliance has been placed mainly on two recognised authorities: Bishop Forbes's *Kalendars of Scottish Saints* (Edinburgh, 1872), and Rev. James B. Johnston's *Place-Names of Scotland* (second edition, Edinburgh, 1903), while the recently issued *Calendar of Scottish Saints*, based on Bishop Forbes's work, by Dom Michael Barrett of Fort Augustus Abbey, has also been consulted.

The geographical distribution of these saintly place-names is interesting from several points of view. So many of the Scottish saints were of Irish origin that their traces are naturally mostly found in the western parts of Scotland. They participated in that wave of migration from Ireland which brought the Scots to Argyll, which was conquered or colonised by the Scots before the end of the fifth century. The coming of the Scots to Argyll synchronises with the period of our oldest Scottish saints.

Besides this, however, the influence of many of the early saints radiated from Iona, on which St. Columba and his companions landed from Ireland in A.D. 563. We are consequently not surprised to find in the following statement of the number of saintly place-names in each Scottish county (according to the list appended to this paper) that the county of Argyll contains by far the greatest number of such place-names:—

Northern Counties.—Shetland 2, Orkney 12, Caithness 4, Ross and Cromarty 9, Inverness 10. In all, 37 place-names in the appended list.

North-Eastern.—Nairn 0, Elgin 3, Banff 4, Aberdeen 19. In all, 26.

Western.—Argyll 52, Bute 10, Dumbarton 3, Renfrew 4, Ayr 13. In all, 82.

South-Western.—Kirkcudbright 6, Wigtown 8. In all, 14.

Southern.—Dumfries 10, Roxburgh 4, Berwick 2. In all, 16.

EASTERN.—Kincardine 12, Forfar 11, Fife 14, Haddington 5. In all, 42.

MIDLAND.—Perth 22, Kinross 2, Clackmannan 1, Stirling 3, Lanark 9, Linlithgow 2, Edinburgh 4, Peebles 1, Selkirk 1. In all, 45.

The 262 place-names derived from saints given in the appended list are thus scattered all over Scotland; but Argyll contains 20 per cent. of the total number.

It will be observed from the place-names themselves that the term "saint" was not originally applied to the person commemorated. The bestower of the name preferred simply to refer to him in affectionate terms, and even to add a diminutive to his name. The *ma* or *mo* frequently prefixed to a saint's name signified "my dear," while *ag*, *og*, or *aig* were diminutives. In this way, as Mr. Johnston points out, *Kilmarnock* near Alexandria (Dumbarton) signifies "the church of my dear little Ronan."

Another peculiarity of the saintly Scottish place-names is that their originators preferred, as a rule, to commemorate their own Scottish Saints rather than the Apostles, or even the Virgin Mary, although the latter is not forgotten. Yet the cult of some of these saints cannot be called local: that, for example, of St. Kenneth extending over the greater part of Central Scotland, and including the modern counties of Argyll, Inverness, Perth, Stirling, Fife, Kincardine, and Aberdeen.

This is not the place to inquire who or what the Scottish saints were. It suffices that we recognise that, without the aid of their names, we should be unable to decipher the meaning of many of the most familiar Scottish place-names. Differences, however, occur between some of the authorities; and, where these affect place-names, they may be referred to.

Thus, the place-name EDINBURGH has led to a considerable conflict of opinion. The common derivation of Edinburgh is from Edwin, who, as king of Northumbria, ruled from A.D. 617 to 634, and whose power extended to Edinburgh. Mr. F. H. Groome, editor of the *Ordnance Gazetteer of Scotland*, even goes so far as to say that Edwin "founded Eadwinesburh or Edinburgh," adding that he "was the mightiest of all the kings of the isle of Britain." (*A Short Border History*: Kelso, 1887.)

According to Bishop Forbes, Dr. Skene, that distinguished Celtic scholar, suggested that the names "Edinburgh and the Maiden Castle" may be derived from St. Medana or Modwena or Edana: and Dom Michael Barrett is of opinion that "Edinburgh probably takes its name from Medana. Her sanctuary, marking one of her monastic foundations, was known as 'St. Edana's,' and was a place of pilgrimage long before the time of King Edwin, who was long supposed to have given the city its designation. Maiden Castle is really Medan's (or Medana's) Castle. Kirkmaiden (or Maidenkirk) in Galloway is another of her dedications, the original form being Kirkmedan." Barrett gives A.D. 518 as the date of St. Medana, or a century before King Edwin.

It may be added that the arms of the City of Edinburgh consist, according to the Register of the Lyon Office, as stated in the late

Marquess of Bute's work on *The Arms of the Burghs of Scotland* (Edinburgh, 1897) of "a castle triple-towered" supported "on the dexter, by a maid richly attired with her hair hanging down over her shoulders, and on the sinister, by a doe proper." The doe refers to the legend of St. Giles, but who was the maid? Lord Bute replies: "The maid is in allusion to the name of the city given in Latin as Castrum Puellarum, and in French as Château des Pucelles, in English Maidenburgh. The M is the Celtic honorific prefix, and leaves the Edin as found in the Teutonic Edinburgh and the Celtic Dun Edin. The change of Medin, or some similar word, into Maiden is the same that we find in Kirkmaiden in Wigtownshire, which undoubtedly signifies the Church of M-Edana, who is the same person as Monynne, called otherwise Modwenna and by a variety of other names, including Tredwind. (The *w* in Modwenna perhaps gives some rational clue to the absurd attempt to derive the name of Edinburgh from the English Edwin.) . . . The use of the M shows that Edana was at any rate regarded as the eponyma by those who called Edinburgh Medanburgh or Maidenburgh, and have given the City arms for supporter" a maid.

This is not, however, the only saintly derivation of the place-name EDINBURGH, for Sir Herbert Maxwell in his *Scottish Land-Names* (Edinburgh, 1894) derives "Dunēdin (Edinburgh)" from "Gaelic *dún Aidain*, Aidan's or Edwin's fortress." He also remarks that "In Teutonic speech, Edinburgh is "Agned's stronghold, but in Gaelic Dunèdin." Mr. Johnston asks, "Who was Agned?" and points out that the Welsh bards of the seventh century occasionally referred to Edinburgh as "Mynyd Agned" (the Mount Agned). St. Aidan died (according to Bœdd) A.D. 651, or later than King Edwin.

Mr. Johnston does not favour either the saintly or the royal etymologies of Dunedin, but prefers to interpret the existing place-name from the name actually given to the place by the Welsh bards of the seventh century, which was Eydden, Eidden, Taliessin, or Dineiddyn, which he states means "fort on the hill-slope" (from the Castle down to Holyrood), the old Welsh being *din eiddyn*, and the Gaelic *dūn eadain* (not *dún Aidain*, as suggested by Sir Herbert Maxwell). This is a singularly felicitous description of the physiography of Old Edinburgh with its "Crag and Tail" formation, celebrated in Scott's lines—

> "Where the huge Castle holds its state,
> And all the steep slope down."

At the same time, Mr. Johnston admits that "without doubt, the name of King Edwin of Northumbria (616-633) did influence the later spellings—indeed influenced the oldest spellings we have, viz. Holyrood Charter (*c.* 1128), 'Ecclesia Sancte Crucis Edwinesburgensis,' and Simeon Durham (died 1130), or his interpolator 'Edwinesburch.' In a charter of Alexander I. (*c.* 1120) we have 'Edenesburg,' and in later charters of David I. (before 1147) we find 'Edeneburg, Edensburg.' As late as 1680 we find 'Edenburgh.' A 'Dunedin' is also mentioned in Roxburghshire.—*Dryburgh Chart.*, p. 83."

Another conflict of opinion occurs regarding the derivation of KILMARNOCK (Ayrshire). Mr. Johnston translates its ancient name (A.D. 1299) "Kelmernoke, 'Church of St. Marnock' = *Maernanoc*, *i.e.* 'my dear little St. Ernan,' priest, and uncle of St. Columba." Both Forbes and Barrett, however, derive it from St. Marnan or Marnock, whose "Scottish name" (says Barrett) "is a contraction of the Gaelic words *Mo-Ernin-og* (my little Ernin)." Ernan and Marnan were totally different saints. According to Forbes and Barrett, Ernan was the nephew (not the uncle) of Columba. They also derive KILMAURS (Ayrshire) from the Scottish saint Maura, whereas Mr. Johnston prefers St. Maurus, a French saint. Lastly, while Forbes and Johnston derive KILMORACK (Beauly) from St. Moroc, Barrett prefers to derive it from St. Mary.

LIST OF SCOTTISH SAINTS, WITH THE PLACE-NAMES DERIVED FROM THEM.

Adamnan, Abbot, A.D. 704. Other forms of name—Aunan, Arnty, Ennan, Eunan, Ounan, Teunan (St. Eunan), Skeulan, Eonan, Ewen, and Arnold.
Ardeonaig, Ardeonan, Kilmaveonaig (Perthshire), Damsay (Orkney), 'Adamnan's Isle,' Killennan (Argyll), Kirkennan (Kirkcudbright).

Adrian or Odran, Bishop and Martyr, A.D. 875.
Oronsay ("St. Oran's Isle"), Killoran (Colonsay), Scour Ouran (St. Oran's Hill), Inverness.

Aidan, Bishop, A.D. 651.
Inchaddon, Kilmadock (Perthshire).

Andrew, Apostle, Patron of Scotland.
St. Andrews (Fife), Kirkandrews (Roxburgh).

Angus, a disciple of St. Columba.
Clach Aenais ("Stone of Angus"), Balquhidder.

Aseph, Bishop, A.D. 590.
Tobar Asheg ("St. Asaph's Well"), near Loch Rannoch.

Bathan, Bishop, A.D. 639.
Abbey St. Bathan's (Berwickshire), Bowden (Bothenden), Roxburgh.

Baldred, Hermit, A.D. 608.
St. Baldred's Cave, Cradle, and Well (Haddingtonshire).

Barr or Finbar, Bishop, sixth century.
Barra ("St. Barr's Isle"), Dunbar (Haddington), Barr (Ayrshire).

Baya, Beya, or Vey, Virgin, about ninth century.
Kilbag Head (Lewis), St. Vey's Chapel (Cumbraes).

Bean, Bishop, A.D. 1012.
Kirkbean (Dumfries).

Begha or Bez, Virgin, A.D. (about) 660.
Kilbucho (Biggar), Kilbagie (Clackmannan).

Berach, Abbot.
Kilberry (Argyll).

Berchan, Bishop.
Kilbarchan (Renfrew).

Blane, Bishop, A.D. 590.
Kilblane (Argyll), Dunblane (Perth), Blane (Bute).

Boisil, Prior of Old Melrose, A.D. 664.
St. Boswell's (Roxburghshire).
Brandon, Abbot, A.D. 577.
Kilbrandon or Kilbrennan (Oban and Arran), Kilbirnie (Beith), Birnie (Elgin), Balbirnie (Fife).
Bridget or Brigida or Bride, Virgin, A.D. 523.
Brydekirk (Annan), Kilbride (Arran, Argyll, Dumfries), Lhanbryde (Moray).
Brioc, Bishop, A.D. 500.
Inchbrayock (near Montrose), Kirkmabreck (Kirkcudbright).
Buite or Boethius, Monk, A.D. 521.
Carbuddo (Caer Buido, "Buite's Fort"), Kirkbuddo (Forfar), "Byth Market" (Aberdeen).
Catharine of Siena.
Sciennes (Edinburgh).
Callen.
"St. Callen's Fair" (Caithness).
Caran, Bishop, A.D. 669.
St. Caran's Well, Drumlithie (Kincardine).
Cathan, Bishop, A.D. 710.
Kilchattan (Bute and Colonsay), Ardchattan (Argyll).
Charmaig, A.D. (about) 640.
Kilmacharmaig (Argyll), Kirkcormaig (Kirkcudbright).
Chroman or Chronan, A.D. 641.
Killichronan (Argyll).
Coivin or Kevin, Abbot, A.D. 618.
St. Coivin's Chapel, Kilkivan, and "St. Kevin's Bed" (Argyll).
Colmoc, Bishop, A.D. 500.
Portmahomack (Tain), Inchmahome (Lake of Menteith).
Colmonel, A.D. 610.
Kilcalmonell (Argyll), Colmonell (Ayr).
Columba or Colum Cille, Abbot, A.D. 563.
Kilmalcolm (Greenock), Inchcolm (Fife), Colonsay (Argyll), Icolmkill (Iona), Kirkcolm (Wigtown).
Congal, Abbot, A.D. 602.
Dercongal (near Dumfries).
Comgan or Congan, Abbot, eighth century.
Kilchoan (Argyll, Ross and Cromarty), St. Coan (Skye), Kirkcowan (Wigtown).
Comman, A.D. 688.
Kilchoman (Islay).
Conan, Bishop, A.D. 648.
Kilconan (Perthshire), St. Conan's Well (Argyll).
Constantine, King and Martyr, A.D. 590.
Kilchousland (Cantyre), St. Cousland's Fair (Forfarshire), Chousland (Midlothian).
Convall, A.D. (about) 612.
St. Conall's Chapel, Ferrenese (Renfrew), Kirkconnel (Dumfries).
Cormac, Abbot, sixth century.
Kilmacharmaig (Kintyre), Kirkcormac (Kirkcudbright).
Cumine, Abbot, A.D. 668.
Kilchuimein (the Gaelic name for Fort Augustus), and near it St. Cumine's Seat and Return.

Cuthbert, Bishop, A.D. 687.
Kirkcudbright (Cuthbert's Church). Churches were dedicated to St. Cuthbert throughout Scotland from Wick to Kirkcudbright.
Cyricus, Martyr, A.D. 314.
Ceres (Fife), St. Cyrus and Eglisgirg (Kincardine).
Dabius or Davius, Priest.
Kildavie (Bute and Mull).
Denis or Dionysius.
Dennis Head (Orkney), Dennistoun (Glasgow).
Devenic, A.D. 887.
Banchory Devenick (Kincardine), "St. Denick's Fair" (Aberdeenshire).
Donan, Martyr, A.D. 616.
Kildonan (Wigtown, Argyll, Ross, Sutherland, and Bute), "Donan Fair" (Aberdeenshire), Eilean Donan (Ross-shire).
Draighen.
Kirkmadrine (Wigtown).
Drostan, Abbot, sixth century.
Craigrostan (Ben Lomond), "Droustie's Well" (Forfar), "St. Drostan's Croft" (Inverness).
Duthac, Bishop, A.D. 1068.
Kilduich, Arduthie, and Kilduthie (Kincardine).
Ebba, Abbess, A.D. 683.
St. Abb's Head (Berwickshire).
Englatius or Tanglan, Abbot, A.D. 966.
Tanglan's Well and Ford (Aberdeenshire).
Ernan, Abbot, A.D. 640.
Killearnan (Sutherlandshire).
Ethernan, Bishop.
"St. Ethernan's Den" (Aberdeenshire), "Tuetheren's Fair" (Forfarshire).
Fergus, Bishop, eighth century.
"Fergan Well" (Banff), St. Fergus (Aberdeenshire), Dalarossie (Inverness), Gael. *dal Fhearghuis*, "Field of Fergus."
Fiacre, Abbot, A.D. 760.
St. Ficker's Bay and St. Fittack's Well (Kincardineshire).
Fillan, Abbot, eighth century.
Strathfillan (Perthshire), Kilphillane (Wigtown), Kilellan (Inverness), Killallan (Renfrew), St. Fillan's Cave (Fife), St. Fillain's Well (Ayr).
Fillan, Faolan, or Faelan ("The Stammerer"), sixth century.
St. Fillan's, Dunfillan, and "St. Fillan's Chair" (Perthshire).
Findchanus.
Kilfinnichen and St. Finnichen's Chair (Argyll).
Findoc, Virgin.
Killintag (Argyll).
Finan or Finian, Bishop, A.D. (about) 575.
Kilfinan (Argyll and Wigtown), Glen Finan (Argyll), St. Finan Chapel and "Finzean Fair" (Aberdeenshire).
Flannan.
Flannan Islands (West of Lewis).
Fumac.
St. Fumac's Well and Fair (Banff and Caithness).
Fyndoca, Virgin.
Findo Gask and St. Phink's Chapel (Perthshire).

Gervadius or Gernadius, A.D. 934.
"Gerardin's Cave and Well" (Elgin).

Giles or Egidius, Abbot, A.D. 714.
St. Giles' Cathedral (Edinburgh), "St. Giles' Fairs" (Aberdeen, Dumfries, and Elgin).

Glascianus or Glass, Bishop.
Kinglassie and "St. Glass's Well" (Fife), Kilmaglas (Argyll).

Griselda.
Ecclesiamagirdle, Pitkeathly (Perthshire).

John, Apostle.
Johnstone (Renfrew and Dumfries), Killean, Killen, and Killian (Argyll).

Kenneth or Canicus, Abbot, A.D. 598.
Kilkenzie, Kilkenneth, Kilchainnech, Kilchainie (Argyll), Cambuskenneth (Stirling), Kennoway (Fife), Auchelchanzie and Ben Chonzie (Perthshire), Balcony (Inverness-shire), Canny River (Kincardine), Kinnethmont (Aberdeenshire).

Kennera, Virgin and Martyr.
Kirkinner (Wigtown).

Kessog, Bishop and Martyr.
"Kessog's Fair" (Cumbrae), Kessog Ferry (Inverness), Tom-ma-chessaig (Callander).

Kevin or Coivin, Abbot, A.D. 618.
St. Coivin's Chapel, Kilkivan, and "St. Kevin's Bed" (Argyll).

Kevoca, Virgin, A.D. 655.
St. Quivox (Ayr).

Kieran, Piran, or Queran, Abbot, A.D. 548.
Kilkerran, Kilcheran (Argyll), Dalkerran (Ayr), Killearn (Stirling and Argyll), Parenwell (Kinross).

Macceus or Mahew, A.D. (about) 460.
Kilmahew (Dumbarton), Kirkmahoe (Dumfries).

Machan, Bishop, about Sixth Century.
Ecclesmachan (Linlithgow), "Church of Machan."

Mauritius, Machar, or Mocumma, Bishop, sixth century.
Machar parishes and Haugh (Aberdeen).

Machalus or Mauchold, Bishop, A.D. 498.
Kilmaichlie (Banffshire).

Machutus or Malo, Bishop, A.D. 565.
Kirkmahoe (Dumfries), Lesmahagow (Lanarkshire), corruption of "Ecclesia Sti. Machuti." [The French town St. Malo (Brittany) derives its name from this Saint.]

Maline.
Legsmalee (Fife).

Martin.
Kilmartin (Argyll).

Mary, The Virgin.
Gilmerton (Midlothian), Kilmarow, Kilmorie, Tobermory (Argyll), Kilry (Fife and Perth), Kilvarie (Perth), St. Mary's Loch (Selkirk), St. Mary's Holm (Orkney), Maryculter (Aberdeenshire).

Middanus or Medan, Abbot.
St. Medan's Knowe and "Maidie's Well" (Forfarshire).

Maelrubha or Mulruy or Mury, Martyr, A.D. 722.
Loch Maree (Ross-shire), Kilmaree, Kilarrow (Argyll), Amulree (Perthshire), Samareirs (St. Mariers, Forres), Summaruff (St. Maruff, Fordyce).

Magnus, Martyr, A.D. 1116.
St. Magnus Cathedral (Kirkwall), St. Magnus Bay (Shetland).
Margaret, Queen, A.D. 1093.
St. Margaret's (Edinburgh), and St. Margaret's Hope (or bay), Queensferry and Orkney.
Marnock or Marnan, Bishop, A.D. 625.
Kilmarnock (Ayrshire), Inchmarnock (Bute), Dalmarnock (Perthshire), Ardmarnock (Argyll).
Maura, Virgin.
Kilmaurs (Ayrshire).
Mayota or Mazota, Virgin, sixth century.
Drumoak or Dulmoak ("Field of Mayota", and "St. Maikie's Well" (Aberdeenshire).
Medana or Edana, Virgin, A.D. 518.
Kirkmaiden or Maidenkirk, and St. Medan's Chapel and Cave (Wigtown, Edinburgh?
Michael.
Kilmichael (Argyll), Kirkmichael (Perth, Dumfries, and Ayr).
Moack or Moucus.
Portmoak (Kinross).
Molios or Laserian, Abbot, A.D. 639.
Lamlash (Gael. *lann Lais*, Church of Laserian) and "St. Molio's Bed" (Arran).
Molocus, Moluoc, or Lughaidh, Bishop, A.D. 592.
"St. Mallock's Fair," "Luoch Fair" (Aberdeenshire), "St. Malogue's Fair" (Perthshire), Kilmoluag, Kilmallow (Argyll).
Modan, Abbot.
Balmodhan (otherwise Ardchattan), and Kilmodan (Argyll).
Monan, Bishop, A.D. 571.
St. Monans and Kilminning (Fife), St. Monon (Ross), "Minnan's Fair" (Caithness).
Monoch or Monachus.
"Sam Maneuke's" (St. Monk's Day) and Auchmannoch (Ayr).
Moroc, Bishop.
Kilmorick and St. Muireach's Well (Dunkeld), Kilmorack (Beauly).
Mundus or Fintan Munnu, Abbot, A.D. 635.
Eileanmunde ("Mund's Island", and Kilmun ("Mund's Church"), Argyll.
Mungo or Kentigern, Bishop, A.D. 603.
St. Mungo's (Dumfries), St. Mungo's Isle (Inverness), St. Mungo's Cathedral and Strathbungo (Glasgow), Balmungo (Fife).
Murdoch, Bishop.
Kilmorich (Argyll), Chapel Dockie (Forfar).
Nathalan or Nauchlan, Bishop, A.D. 678.
St. Nathalan's Fair and "Naughlan's Well" (Aberdeenshire).
Neamhan, Martyr.
Kilmonivaig (Argyll).
Nennidius.
Kilninian (Argyll).
Ninian or Ringan, Bishop, A.D. 432.
St. Ninian's (Stirling), North Ronaldshay or Rinansey, "Isle of Ringan" (Orkney), Kilrenny (Anstruther), St. Innian's Well (Lanark), St. Ninian's Chapel (Linlithgow), Ringan's Dean (Roxburgh), Kilninian (Argyll), St. Ninian's Den and Chapel (Kincardine).

Obert.
"St. Obert's Eve," Perth.
Olaf or Olave or Ollow, King and Martyr, A.D. 1030.
Ollaberry ("Olaf's burgh") Shetland, "St. Ole's Fair" (Lewis), St. Ollowe's Bridge (Kirkwall).
Osborne.
Closeburn (Dumfriesshire), *G. cill Osbern.*
Oswald, King and Martyr, A.D. 642.
Kirkoswald (Maybole).
Palladius, Bishop, A.D. 430.
Aberfeldy (Perthshire), Paldy's Well (Fordoun), and "Paldy Fair," Kincardine.
Patrick, Bishop, A.D. 493.
Kilpatrick (Dumbarton), Ardpatrick (Argyll), Dalpatrick (Lanark), Kirkpatrick (Dumfriesshire), Kilpatrick (Arran).
Pensandus.
Kilspindie (Perthshire).
Peter, Apostle.
Peterculter (Aberdeenshire), Kilfeather (Wigtown).
Regulus or Rule, Bishop.
"Trewell Fair" (Aberdeenshire), St. Regulus' Tower (St. Andrews).
Ronan, Bishop, A.D. 737.
Ronay (Skye and Lewis), Port Ronan (Iona), St. Ronan's Well (Peebles), Kilmaron (Fife), Kilmaronock (Dumbarton), Kilmaronog (Argyll).
Servanus or Serf, Bishop, sixth century.
St. Serf's Isle (Loch Leven), "St. Shear's Well" (Dumbarton), "St. Serf's Fair" (Linlithgow and Perthshire), Dalserf (Lanarkshire).
Suibhne (Sweeney), Abbots of Iona, A.D. 657 and 772.
Castle Swen (Argyll).
Talarican, Bishop, A.D. 616.
Kiltarlity (Inverness-shire), "Tarkin's Well" (Banff and Stirling shires).
Ternan, Bishop, A.D. 431.
Banchory Ternan (Kincardine).
Thenew or Thenog, A.D. 514 (Mother of St. Mungo).
St. Enoch's (formerly "San Theneuke's Kirk"), Glasgow.
Triduana or Tradwell, Virgin, sixth century.
Kintradwell (Caithness), Tradlines (Kincardine), St. Tredwell's Loch and Chapel (Orkney), "St. Trodlin's Fair" (Forfarshire).
Vigean or Fechin, Abbot, A.D. 664.
St. Vigean's (Forfarshire), Ecclefechan (Dumfries).
Volocus or Wallach, Bishop, fifth or sixth century.
St. Wallach's Baths, Wallach's Kirk, and St. Wallach's Well (Aberdeenshire).
Wynnin Finian or Frigidian, Bishop, A.D. 579.
Kilwinning, Caerwinning and St. Wynnin's Fair (Ayrshire), Inchinnan (Renfrew), Kirkgunzeon (Kirkcudbright), Lumphanan (Aberdeenshire), Lumphinnan (Fife).
Yrchardus or Merchard, Bishop, fifth or sixth century.
Merchard's Seat, Well, and Churchyard (Inverness-shire).

EAST AND WEST.

By Victor Dingelstedt, Corr. Member R.S.G.S.

Introductory.—Since its first appearance on the earth mankind has multiplied continuously. Its offspring—determined by innate or hereditary powers and by the external conditions, viz. climate, situation, and environment generally, they were placed in by accident, or their own will—has progressed slowly, discontinuously, and unequally. Whilst on some favoured places on the face of the earth man has succeeded in organising powerful and prosperous communities, in many other places he has continued to struggle with great disadvantage, and made no progress. Progress once attained has not been always maintained, and has often been reversed. New obstacles, natural or artificial, started up to bar its way, or to produce retrogression; some advanced nations have been washed off by the tide of adversity, new factors have determined the growth and advance of other groups of humanity which had long remained backward, and thus the wave of progress, like the waves of the ocean, has been swelling and subsiding in turn.

The actual result of all this shifting during hundreds of centuries is the differentiation of mankind out of primitive, more homogeneous, conditions into the exceedingly heterogeneous state of our political and social world.

Passing over the perplexing details, it is possible to discern in this heterogeneous whole some grand lines of general characteristics concerning the mental, social, and moral conditions of man, which justify us in dividing mankind into a small number of more or less widely distinguished worlds, having each in common its proper mark. One of the grand divisions, which best answers to reality and embraces the vastest number of men, is perhaps that suggested by the title of the present article—East and West. We have Eastern and Western worlds, Eastern and Western civilisations; the first of these being again capable of subdivision into Far and Near East, and the second into Far and Near West.

The present writer, who has long resided in the East, asks leave to present to the readers of this *Magazine* some considerations and data about these two different worlds and their mutual relations. This subject, at the present moment of a violent collision between two most powerful Eastern nations, may not be without some interest.

Eastern Nations.—To the Eastern nations belong Letto-Slavs, Hindus, Turks, Tartars, Persians, Tibeto-Indo-Chinese, Georgians, Armenians, Jews, Syrians, Arabs, and a considerable number of nomad people, mostly Mongolo-Tartars.

They occupy the whole of Asia, the eastern half of Europe, and the north of Africa from the Red Sea to the Atlantic.

They constitute about fifteen states, among which only Russia, Japan

and China, and Abyssinia may be considered as quite independent; whilst Turkey, Persia, Afghanistan, Korea, Morocco, Nepal, Bhutan, and Siam, though nominally independent, have lost some of the privileges of sovereign and autonomous states: Tunis is under a protectorate. India and its dependencies are a part of the British Empire; Annam, Cambodia, Cochin-China, Tonking, and Laos are French colonies.

Of a total Eastern population of about 890 millions, occupying an area of 17½ million square miles, about 400 millions belong to China, 222 millions to Britain, 116 millions to Russia, about 44 millions to Japan, and 40 millions to Turkey. There remain about 29 millions acknowledging the sovereignty of France, and the rest, 39 millions, are divided between Persia, Afghanistan, Korea, Abyssinia, Morocco, Nepal, Siam, and Bhutan.

Far Eastern states have a density of population of about 270 per square mile; Near Eastern states—the Ottoman Empire, Persia, Morocco, and Abyssinia have a very sparse population of only about 20 per square mile; whilst the density of population of most of the Asiatic states directly dependent on Europe is about 120 per square mile.

Any attempt to formulate general characteristics for such vast numbers must necessarily be a matter of great difficulty. There is a great diversity of culture, mental bearing, races, occupation, social, religious and political conditions among the Eastern as well as among the Western nations; yet the notion of an Eastern world is surely something more than a geographical designation of a part of the globe to the east of a given meridian, it expresses some real difference between the inhabitants of the East and of the West of our old continents, and we believe it is possible to indicate with some approximation to the truth in what this difference consists.

Characteristics of Oriental Nations.—These characteristics may be considered from the political, social, mental, moral, and economical standpoint.

All Oriental peoples, with the single exception of Japan, and that quite recently, are governed on autocratic principles, sanctioned by religion and authorising the blending of all legislative, administrative, judicial, military, and ecclesiastical powers in a single ruler. A natural consequence of such a political organisation is the prevalence of arbitrary powers, the number of petty tyrants, the insecurity of rights, the interference of religion in civil matters and in customs and habits of everyday life, oppression of the poor, callous disregard of the value of human life, cruel laws, peculation and corruption among the governing classes, the subordination of national, economical, and moral and intellectual interests to the considerations of prevailing religions, dogmas, etc.

Whilst in the West the Church has been to a certain degree modified by political, national, economical, and scientific influences, the Church in the greatest part of the East maintains its ascendency and governs the political institutions as well as the mental and economical activity of nations. Religion is closely bound up with education and instruction.

As characteristic of the East in social respects we may mention the great social inequalities; the marked dependence of women upon the sterner sex, their seclusion on the principles of the zenana, their sub-

servience to the needs and caprices of men, their exclusion from political influence. In most Eastern countries males outnumber females, and all adult women are usually married and provided for. In the absence of legal rights the women resort to arts and wiles and subtle influences: they are even more conservative than the men.

The Eastern world is mostly communary and strongly gregarious: it continues the old types of the clan and the horde, which simplify life and make it easier, restricting at the same time the possibility of any individual emancipation and of progressive development.

Eastern society is anti-democratic, decorous, ceremonious, polite, deceitful, self-conceited, dull, lazy, effeminate, sensual, sluggish, mentally inactive.

As to the mental characteristics of Eastern peoples, they have a general tendency to consider (in contrast to Western peoples) quietude of mind and body as of the highest bliss, mental and physical labour as pain and suffering, and the most complete detachment from the prosaic needs of existence as highly desirable. This indisposition for labour and the habitual sluggishness of mind do not exclude sudden outbursts of violent and passionate activity under religious and warlike motives.

In the ordinary course of life Orientals, with some notable exceptions, are prone to mysticism, religious vagaries, soothing poetry, love of the marvellous: they like fables and recitals of heroic deeds. They are mostly fatalistic, patient, resigned, sober, dignified, slow in movement, unmindful of the value of time, highly conservative.

In the pursuance and development of true knowledge, which is steadily revolutionising the Western world, the inhabitants of the East have remained backward; they do not dare to consider the phenomena of nature from a scientific point of view, and they have preserved in their conceptions the sentimental logic proceeding from the conclusions created by their feelings.

With the obvious exceptions of Russia and Japan, and those parts of the Orient which are dependent on Britain, no science in the strict sense is taught in oriental schools: its place is taken by religious teaching, the wise sayings of ancient authorities, metaphysics, poetry, and different kinds of theological exercises quite fitted to stunt the intelligence and prevent independent thought. The mind of the Oriental contains but few ideas; but these are permanent. These ideas, being repeated from generation to generation during a long lapse of time, have become, so to say, part and parcel of a man's character, compelling him to implicit obedience, leaving him no choice and directing him as an automaton. Hence his fanaticism, his intolerance, incapacity of understanding another's mental disposition, hatred of foreigners, staunch conservatism, want of suppleness and the great rigidity of his formulæ. Being under despotic government and the reign of arbitrary power, the Oriental has learned the art of concealing his real sentiments to a remarkable degree; he is a born diplomat, he is a master of hypocrisy, and nothing is more difficult than to pierce through his habitual air of resignation, his calm, respectful, and dignified demeanour.

It is not at all easy to judge Oriental peoples from the ethical or

moral standpoint. It is certain that their morals are in many respects different from that of Western people, but whether they are lower or higher than ours is quite another question, which we believe defies a rational answer. We are tending in our days to reject any theoretical conception of duty, and we are endeavouring to find for our morals a scientific basis in the impartial study, according to experimental methods, of the conduct of human society, considered in the same way as any other natural phenomenon.

From this point of view the actual conduct of numerous Oriental societies, preserved unchanged from oldest antiquity, may have a real interest for the true foundation of the science of comparative ethics.

From the economic standpoint the Oriental nations differ also vastly from their Western brethren. The main features of the economic aspect of Eastern peoples are the feeble development of roads and railways, the absence of machinery, the slight use of steam and electricity, the abundance and cheapness of unskilled labour, the exclusion of women from trades and great manufactures, the vast preponderance of agriculture over manufacturing and mining industries, and the prevalence of small domestic trades as compared with great manufactures.

In their industries, as in their commerce, the Eastern nations are highly conservative. Custom, use, habit, are the Oriental's creed. Such is their ingrained conservatism, that unless what they need is put before them, not only in the quality but in the shape in which they are accustomed to see it, nothing will be done. A Persian, for instance, will not buy a sugar-loaf unless it has not only the usual weight and shape but is also enveloped in a paper of the usual colour.

In dealing with Orientals one does not easily win their confidence; there is the custom of prolonged bargaining, yet important transactions may be conducted with astonishingly few formalities, and the receipt of large sums is acknowledged on a small scrap of paper.

It is unnecessary to point out how immensely rich are some Eastern countries, which produce such valuable raw products as tea, silk, opium, musk, rice, cotton, sugar-cane, oilseeds, indigo, tobacco, wool, spices, lac, coffee, madder, gums, wine, sponges, etc. etc.

Eastern people are generally vindictive and revengeful; they like to take the law into their own hands, but if they address themselves to a tribunal it must be prompt, public, and without formalities.

They have much veneration for aged persons; an old man is a natural chief, judge, or adviser; an old woman rules the house.

Eastern hospitality is proverbial: in the social intercourse much importance is attached to all external, formal manifestations of friendship and goodwill. The Eastern people like compliments, they are ingenious in presenting them, and push them to an extravagant degree.

In the distribution of public offices in most Oriental countries considerations of age, birth, and wealth are taken into account.

To an Oriental a leader is indispensable; he relies on the past, he believes in the customs of his Fathers and the Gods. An immemorial prescription is more binding on an Oriental than the last legislative enactment.

Most Oriental languages, such as Hindu, Persian, Tartar, are surcharged with glamour; an Oriental is a born flatterer.

The Oriental is the most unpractical of mankind; he adheres to old rites, old residences, old cities. Manual labour is well adapted to the retrograde spirit of an Oriental. He distrusts recuperative undertakings, and buries his treasure in the earth. The feature of Oriental life is village industries in the village community. The tendency of many Oriental nations is not progressive.

Distinct Groups of Orientals.—These are some characteristics of the Eastern nations in general, of which there are, however, important limitations. In order to better appreciate what is meant by the Eastern world it is necessary to divide it into some separate groups, and consider each of them in particular.

We can very roughly distinguish four such groups: (1) pastoral and nomad peoples, (2) corrupted and decadent but once powerful nations, (3) extra-conservative stationary nations, and (4) progressive and advancing nations.

Numerous tribes spread over the vast expanse of plains and mountains in Asia and North Africa, having preserved prehistoric nomad habits, rearing cattle and pursuing the chase and a predatory life and living in tents, under the open sky, are not Oriental in the sense we attach to this word. They may be considered as a kind of reserve of humanity which bountiful Nature keeps in order to heal and regenerate by infusing a new blood into those parts of humanity, either in the East or in the West, that may become physically and mentally degenerate in consequence of the neglect of Nature's dictate.

These simple children of nature—Turkomans, Kurds, Arabs, Gipsies, Tartars, Berbers, Cossacks, Tchuvashes, Kirghis, Kalmucks, Samoieds, Meao-tze, Mongols, Dravidians, Jungus, and many others—have remained outside of civilisation. They have preserved many natural virtues, their principal need is space and liberty, they maintain a healthy and vigorous body, they are inured to the inclemency of the weather, they lead a simple and sober life.

The study of these tribes presents great interest, and in the twenty volumes of this *Magazine* there are to be found many excellent descriptions of some of them.

In the second group of Oriental nations, those who have enjoyed in the past predominant power and high civilisation, and later on have been conquered, crushed, dispersed, or reduced to dependence, we may reckon Persians, Turks, Egyptians, Jews, Armenians, Georgians, Finns, Lapps, Uzbegs, and Hindu. These are truly Oriental people with those characteristics which attach them to past glories, a mixture of splendour and misery, richness and squalor, haughty pride and servile subservience.

As typical Oriental people may be taken the Turks and Persians. Turks are a numerous, widely-spread family of the human race, containing, according to Dr. Latham, ten tribes, among whom the most important are Ottoman or Osmanli—the Turks of the Turkish Empire; the Uzbegs—the Turks of China and Bokhara; the Nogays, Bashkirs, Teptyars,

Baraba, and other remnants of the Keptchâk, called Tatars or Tartars, which is not an ethnological term, and which embraces a number of tribes brought under Mongolic sway by Genghis Khan, and belonging to the Turanian family.

Except Osmanlis, the Turks partake more or less of the Mongolian type. This type tends to become modified, and even to disappear entirely among the more civilised Turks in larger cities, a fact which may well correspond to some change in mental characteristics.

Osmanlis are a proud nation of conquerors, reduced to considerable dependence and becoming victims of misrule through their inability to organise their State on rational principles of self-government. In feature, height, and general physical structure, they bear a strong resemblance to other European nations, and are certainly quite capable, under favourable circumstances, of high culture.

Persians—the French of the East—are perhaps the most sympathetic and pitiful of truly Oriental nations, and are also victims of a very bad government. They are Aryans, and this fact proves that all human families are subject, under definite circumstances, to Oriental vices. The Persians boast of a very ancient civilisation, their illustrious history begins some thousands of years before the Christian era, they are endowed with brilliant physical and mental qualities, quickness of intellect, exquisite poetical sensibility, affability of manners, love of splendour and display. They have been compared to Attic Greeks; and yet, in spite of all, the modern Persian is to be profoundly pitied. His splendid country, now mostly desert, has been ruined by misrule, extortion, neglect of irrigation works, the frequent occurrence of famine, absence of roads, brigandage, general insecurity of life, ignorance, superstitions, corruption of every kind, and other innumerable calamities.

Persia or Iran, though occupying still an area of about three times that of France, has a miserably small population of only about 7,500,000.

Persians, or rather Tajiks, as the main settled population of Persia are called, the descendants of the ancient Persian race, seem to represent a very old nation incapable of regeneration, and yet one can hardly reconcile oneself to the idea of a whole splendid nation dying like an individual. There are still authorities which do not despair of the future of the Persians. Mr. Vambéry in his work, *Central Asia and the Anglo-Russian Frontier Question*, says that what the Japanese are in the East the Tajiks may become in the West of Asia; they will form the medium for the introduction of the civilisation of the West into the interior of Asia.

Tajiks, like other Persians, may certainly prove capable of a new period of vigorous activity under changed circumstances, but Persia as a state directed by a most corrupt and despotic government, allied to a most fanatical clergy, is doomed to a definitive collapse, like many other old Asiatic states who have lost their independence—the Hebrew, Armenian, Georgian, and others.

We will not speak of the Hebrews—that old Oriental nation, whose

strange and lamentable history has become a sacred history for Christians, and who are too well known as cosmopolitan citizens to need a description on our part; but we would like to say some words about the last two, also very old and very remarkable Eastern nations—the Armenians and Georgians (Cartvelian).

These two nations are antagonistic, and have indeed very opposite vices and virtues. Both were early civilised and christianised, and later on also prematurely arrested in their expanse by crushing Oriental despotism, and by foreign and intestinal wars. Yet—and therein lies a great interest—thanks to racial differences and also different climatological and geographical influences, each has had quite distinct and characteristic fates.

Georgians or Cartvelians (subdivided into a number of minor nationalities—Mingrelian, Immeritian, Gurian, Lazy, and others) have generally become a rather improvident people, little capable of the sustained energy and perseverance of purpose that are so essential for success in the struggle for existence. They are sturdy, intelligent, chivalrous, easy-going, light-hearted, fond of love-making, lazy, merry, music-, dance-, and wine-loving people, rather quarrelsome, exceedingly ignorant and superstitious, in the way of impoverishment and steady decadency.

Their antagonists, the Armenians, are quite another set of people. Industrious, hard-working, persevering, shrewd, cunning, serious, rather sordid and cruel, they succeed in commerce and money-making, they appreciate knowledge, they are business-like, and with better schools they will certainly show themselves capable of competing with any of the Western nations; they are the Jews or the Greeks of the East.

In the highly appreciated work of Mr. H. Lynch upon Armenia (cf. *S.G.M.*, vol. xviii.), the Armenians are regarded as being fitted by their history and character to become intermediaries in the higher things of life between the enlightened and progressive nations of the West and the sunken or sluggish nations of the East.

There are many other Eastern nations who approach these two types, as, for instance, Javanese, who are, like Cartvelians, proud, improvident, prodigal, incapable of sustained attention, wanting in initiative. They are the natural victims of other sets of people with opposite defects, such as Chinese, Jews, Greeks, Armenians.

The Hindu is a highly important Oriental nation to which apply most of the characteristics we have given above—in language, manners, customs, institutions, industries and arts; they are the antipodes of ourselves, and perhaps the study of no other nation is better adapted to illustrate the profound influence on men's minds of climate and environment.

The third great group we may distinguish among the numerous Eastern nations belongs to the Tibeto-Indo-Chinese race, inhabiting Tibet, China, Japan, and Indo-China. This human stock is certainly likely to attract greater attention from the West in the future than heretofore, and it may perhaps play quite as important a rôle in the world's politics as its Western rivals.

The Chinese proper are an Oriental nation of Mongolo-Tartars,

differing from other members of this family by a far higher civilisation, and consequently also in general appearance.

It is not easy to form a fair and impartial judgment of the psychological character of the Chinese, and there are great differences as regards conclusions even among those who have long resided in their country. In some respects they do not seem to respond very exactly to the definitions of Oriental character we have tried to summarise above, for they are active, industrious, clear-headed, practical, unimaginative, without deep religious feeling; but that notwithstanding, they are truly Oriental in their staunch conservatism, their political organisation, their spirit of submission, want of individual initiative, their liking for ceremonies, their gregarious feeling, their ignorance of scientific research, their worship of ancestors, their sobriety, filial piety, and many other traits.

The Chinese are also renowned for their love of peace and domestic order, their communal institutions, and also for cruelty, inhumanity, and uncleanliness. They are afflicted with a strange hydrophobia, which prevents them from washing; they are perhaps the most enduring of all peoples, and therefore highly adapted for a severe struggle for existence. Their presumption and self-conceit stamp them also as truly Oriental people; they are quite satisfied to consider themselves as Celestials, "Men of the Great Nation," and of all the resources of modern civilisation they take kindly only to the manufacture of weapons.

The Chinaman, according to Mr. P. d'Enjoy, has a vocation for social solidarity. From the day of his birth he is affiliated by his parents to one or more associations, secret and official, and when he is able to dispense with parental care he makes a choice of others which seem adapted to his needs. When he changes his locality he is assured beforehand of finding a fellow-member at his new dwelling. The Chinaman's fondness for associations arises from the family principle; he cannot understand social life combined with individualism; he has a horror of isolation: even in death he fears solitude.

The Japanese are an old Eastern people on the highway to playing a most influential rôle in modern history, and are causing us in the West completely to change our preconceived and false ideas about the value of yellow races in the Eastern world. This wonderful nation is indeed about to teach us many new things.

Japan has accomplished in one generation what in Russia Peter the Great had undertaken two hundred years ago, and it seems now about to triumph over the huge Empire of Peter. It officially announced, only thirty-two years ago, that "it desires to borrow from civilised nations those of their institutions which are the best adapted for the peculiar conditions of the country, appropriate them by means of successive reforms and ameliorations in politics and habits, in order to raise themselves to the same level as these nations." How quickly and effectually the Japanese have proceeded in order to attain the desired level of other civilised nations we were able to judge even twenty years ago from the able paper about Japan read before the Royal Scottish Geographical Society by Mr. Russel Robertson, H.B.M. Consul at Yokohama (vol. iii.),

and what progress they have made since we can well judge from the course of the struggle with their gigantic neighbour.

One of the most curious characteristics of the Japanese is that they are the most dexterous people on the face of the earth, the most courageous, and the most resolute to carry out with all speed and energy a plan prearranged after slow and long deliberation.

There are many other nations belonging to the same Tibeto-Indo-Chinese race, such as the very ignorant and superstitious Tibetans, governed by monks, and having as yet maintained polyandry; the excitable and impulsive Burmese, clever, proud, and patriotic; the far less excitable but not so clever, and rather shy and retiring Karens; the persevering, enduring, and courageous Shans, wonderfully apt traders and pedlars; and, finally, a number of wild tribes such as Chins, Kachings, Palungs, etc.

In India the number of different tribes and nations is so considerable, and they seem to differ so much in temper, civilisation, and character, that hardly any general statement can be applied to them; yet we can see that, even between the acute and timid Bengali, warlike Sikh, proud and fierce Afghan, patient Dacca, high-spirited Rajput, mercantile and prudent Parsees, there is one trait in common—they are Oriental in their ways, and as such not to be confounded with Western people. Take the case of the Rajput: he has a wild and uncouth gait, and yet his truly Oriental refinement and courtesy have become proverbial. A sick member of this race being inquired by a European official after his health, replied, "The sight of you makes me better, sir."

Finally, we have to mention the most numerous and the most important semi-Oriental nation, which has succeeded in bringing under its dominion the whole of Eastern Europe from Barent's Sea to the mountains of Ararat, and the whole north of Asia from the Ural to the Pacific. The Russians, whilst answering to the most essential of the characteristics of an Oriental nation as we have tried to summarise them above, are, however, to be considered as only semi-Oriental in consequence of the prolonged, though perhaps superficial, influence exercised on their destiny, from the time of Peter the Great onward, by European culture, Western arts, science, and institutions. This influence has produced a wonderful amalgamation of Western and Eastern ideas and institutions, a mixture of East and West, of the modern with the ancient world, the typical instance of which is presented in the first capital of Russia with the bewildering eccentricities of its architecture, to which every city of the world has sent its own characteristic building—Greek, Italian, Byzantine, Mongol, Goth, Moor, Tartar.

Western culture has not, however, greatly touched the great mass of the people, with its 85 per cent. of peasantry who, though potentially capable of high culture, as is proved by some of their undoubted representatives, remain still Oriental, though perhaps on the eve of awakening from Oriental dreams and misery.

In the vast Russian Empire itself the West is opposed to the East. On its western border live old cultured nations, Poles, Germans, Finns; whilst in its eastern and larger parts roam nomads, wild tribes, and

numerous remnants of once civilised and now degenerate and corrupt Oriental states founded on the ruins of Tamerlane's Central Asiatic Empire.

In their nature, as in their language, Russians have rather a concrete than an abstract tendency; but they don't like exact sciences, and prefer such as sociology, political economy, and history, which are vague. An abstract idea, for instance, such as "social foresight," can be hardly rendered adequately in Russian. They have not such a word as "one" used as a general or indefinite denomination for any man, any person. There are no Russian philosophers, their concrete language being unsuited for philosophy. They have not an analytical, but a visual, realistic spirit.

The average Russian is generally improvident; he has little perseverance, he likes change, and is easily satisfied with quite superficial studies; he does not like details, and is easily influenced by general, broad, vague conceptions. He is remarkably free from social prejudice in that sense that he is rather indifferent to the habitual petty rules of moral conduct obligatory in Western Europe. He does not, in consequence, consider it always necessary to be polite, to answer one's letter, or to return one's visit, etc. It is not easy to shock or scandalise a Russian; he has in morals a frank and easy-going simplicity.

Russians are fatalists, resigned; their "avosj" is proverbial, and causes them to undertake the most serious things at random. According to Turgenef, a Russian dies admirably well. The Russians are not inventive; their arts, industries, are imitative. They do not practice art for art's sake, but in every artistic production they require a tendency, and judge it according to the more or less sympathetic nature of this tendency.

Russian hospitality is proverbial. This virtue is pushed sometimes to extravagance, and instances of Russian noblemen having ruined themselves in entertaining their friends and neighbours are numerous. An average Russian has no solidity in his principles, he does not like restraint, and breaks through at the first opportunity. Russians say of themselves that they love broad natures.

Factors which have shaped the Oriental Mind.—After having stated what we consider the characteristics of the Eastern world and mentioned some of its most important representatives, the present writer would like now to examine some conditions or factors, geographical, historical, psychological, and economical, to which may be, at least partially, attributed the formation of the Eastern type of mind, and hence Eastern institutions.

Nations, like individuals, are what their innate racial peculiarities, influenced or worked upon in a continual interchange by the numerous natural and artificial agencies of a given physical and social environment, have made them.

To elucidate the psychology of a distinct group of mankind it is therefore necessary to examine the race, the geographical conditions, the social relations, the historical, economical, and religious factors.

In so vast a subject the writer must necessarily confine himself to

some general remarks, recommending to those who would like to study the action of climate, situation, occupation, and environment generally on men, the capital work of Robert Brown, entitled *The Peoples of the World.*

Race.—For the elucidation of the causes which have contributed to the formation of the Eastern mind we may briefly dispense with the question of race. Though a considerable majority of the Eastern nations belong to the Mongolians or yellow type of man, yet among the true Easterns there are numerous white races, and besides, there is now hardly any serious foundation for maintaining the notion of the absolute superiority of white races. Mongolians have a glorious record. Early in history a Turanian race (Accadians) constituted the more cultured section of the Babylonian state. A great offshoot from the Mongolian stock has founded an Empire in China.

Scythians and Huns were highly enterprising; the former, presumably the ancestors of the later Turks, spread from Independent Tartary westward round the Caspian into Russia, Transylvania, and even Eastern Hungary; the second under Attila extended their dominion over the people of Germany and Scythia, viz. from the frontiers of Gaul to those of China (434 A.D.).

The Tartars had much to do with early Indian civilisation. The great world-conquests of a Genghis Khan and of a Tamerlane are too well known to leave any doubt of the glorious past of the Mongols, and if we remember that the Magyars and Nippons are of Mongolian origin, we must surely reject the idea of the inferiority of the Mongolian or yellow races to the white race.

Far more potent in the formation of the Eastern character than race have been the historical factors. The earliest human culture began in the East, where were founded the first powerful civilised communities—Assyria, Babylon, Nineveh, Persia, Chaldea, Media, etc. This early beginning of culture and its development had given to the descendants of these ancient monarchies that knowledge and experience, that worldly wisdom, which in the case of a nation, as in that of an individual, make up old age. The past weighs heavily upon the present; and most Eastern nations are old nations, and many of their peculiarities are those of an old and decrepit age.

Another important historical fact is the migration of races, which may have greatly contributed to the actual differentiation in men's mental characteristics and habits. Those who leave their homes and travel learn many new things, acquire more experience; whereas those who remain at home become only more rooted in their old habits and less inclined to change their ideas. The progress of the world has proceeded from East to West, corresponding in a way to the migratory and travelling instincts of nations: the farther a people travels westwards from its old Eastern home, the more has been developed in it the desire for travelling abroad, the more it shows itself accessible to learning new things, the more advanced becomes its culture.

Climatological and geographical factors are perhaps yet more important than historical in shaping men's mind, the latter greatly depending

on the former. The physiographical features of Asia and the Eastern half of Europe have exercised the more potent action on the destinies and characteristics of nations, the less these nations have been armed in the primitive age of culture with the weapon of experimental science which alone ensures their dominion through knowledge of nature's laws. Scenic grandeur struck the mind of ancient populations in the East with awe, and inspired them with profound religious feeling, which in the hands of the clergy has become a most potent power in submitting Oriental communities to the theocratic monarchical power, which remains as a distinctive character of the East in our days.

An excellent appreciation of the influences exercised by the forces of nature and physical geography upon the imagination, the lot of man, and upon his political history, was made before the Royal Scottish Geographical Society in 1888 by Sir William Wilson Hunter in his Anniversary Address. What he has said about India may be applied to many other Eastern countries, where the overwhelming forces of nature, assisted by man's ignorance, pressed, and are still heavily pressing, on the imagination of man and his ideas about God. These forces deprive man of his free-will and intelligence, develop in him strong gregarious instincts, and impose upon him a minute and imperious discipline, regulating his social institutions, industrial economy, his public and even his private daily life, his habits and customs.

A partial emancipation of man from these forces of nature will come only with the advent of Science, which gives confidence to his brain powers, creates individuality, and permits him to direct these powers at his will for his wellbeing.

To the formation of the Eastern mind may have also powerfully contributed the kind of occupation, or the economical activity, of people dependent on climate, soil, geographical situation. Most Eastern peoples have pastoral and agricultural habits, which tend to develop conservatism, submission, patience, resignation, respect for tradition.

However it may be, and whatsoever are the numerous factors that have contributed to shape all the peculiarities we may observe in the life of Eastern nations as compared with that of Western nations, we contend that our distinction of two worlds, Eastern and Western, is founded on reality, that we are now actually in presence of two different kinds of civilisation and mental characteristics unequally distributed on our planet.

The Mutual Relation of the West and the East.—In the presence of actual shrinkage of the world in consequence of the increased facility of locomotion and travelling and commercial relations, there is a growing necessity to effectuate *rapprochement* between the West and the East, which can only be done by better knowledge of one another, by increasing sympathy and goodwill. This *rapprochement* cannot fail to increase the general progress of humanity in the equal interests of both parties. The Orientals have to learn something from us Western people, but we have also much to learn from Orientals.

Our civilisation, though higher, is very far from being perfect. There are many and serious flaws in it. The little knowledge and

material prosperity we have acquired do not increase much our contentment, nor our happiness; it has rendered our life more busy and feverish, it has opened new vistas, but also new dangers, and we have had to pay for it by physical degeneration and a general increase of nervousness, consumption, alcoholism, mental alienation, and a number of new diseases. It would be easy to trace a very sombre picture of the actual physical, social, and moral states of many Western countries, notwithstanding their growth in wealth, population, and influence. An armed peace, which costs milliards of money, taken from toiling crowds of always more dissatisfied workers, and an utter incapacity for any serious common action in view of mutual jealousies, do not certainly speak much in favour of our Western civilisation. The truculent tendencies of modern democracy, on the other side, are far from being congenial to the higher classes of human society—artists, thinkers, and poets. Modern life is too hard a thing, too jarring and keen, and too artificial, to give sufficient rest and contentment to a soul bent on admiration, on a simple life in the bosom of nature.

Whatever are its intellectual acquirements, its culture and moral refinement, every human society is under obligation to remain in its own mode of life true to nature, in order to ensure continuity of normal and healthy development, the maintenance of the very forces which are engaged in progress or evolution. There are many roads to Rome, say Italians, and there are many possible roads for nations in pursuance of what they consider their interests.

Each nation has to leave to the better judgment of another what best it has to do to ensure its happiness, whether it profess Western or Eastern modes of procedure.

Unhappily, the world has never shown itself very tolerant, and in the history of mankind there are many and bloody struggles and violent collisions between Western and Oriental worlds. There have been aggressive movements initiated in turn on the Eastern and on the Western sides; but in our time, since the great progress made in military art, the aggression begins exclusively from the West, which seeks to impose on the other side not only its manufactures, but also its religious and political ideas, and its modes of thought. These struggles could not but embitter mutual relations.

It is quite probable that the success of Japan in its struggle with Russia will raise the influence of the East in the councils of nations, and give a check to the preponderance of the West and its abusive interference.

The true solution of the problem of such relations between different groups of humanity as will lead to their mutual benefit and general progress, is not to be found in wars and conquests, but in a largely sympathetic attitude of one towards the other, in a desire to know better one another, and in a generous tolerance and a clear appreciation of one another's mental characteristics.

The actual course of events, gradual enlightenment, increase of commerce, multiplication of means of communication, a greater sense of solidarity, scientific progress, are all tending to the *rapprochement* of the Western and Eastern parts of our globe.

Independently of that, different civilised nations in Europe and America are steadily making efforts, with unequal success, to approach the Eastern world and reconcile it to their interests and exigencies.

Great Britain and Russia are naturally called upon to exercise the most conspicuous influence upon the Eastern world; after these come France, Germany, America, and Holland.

Great Britain rules the destiny of India, the most ancient and typical and the richest Eastern country, the ancient Empire of the Great Mogul, containing a population of about 300,000,000, more than half of whom are agriculturists (171,735,000). Russia, semi-Oriental itself, has in its possessions ancient Central Asiatic states, Turkestan, Caucasus, Siberia, with about 23,000,000 inhabitants, spread over an area of 6,500,000 English square miles.

These two great Powers treat their Oriental subjects differently, but the writer does not believe that either system is quite successful. British government in India, according to Sir John Strachey, is not only one of the purest in intention, but one of the most beneficent in act, ever known among mankind (*India, its Administration and Progress*, 1903). That is the European point of view of an eminent Englishman; but are we justified in judging an Oriental state according to our Western conceptions? What do the Hindus say about that? Do they love the English? Do the last completely trust their Oriental subjects? If it were so, what need would there be for a European army to defend the frontiers of a country with 300,000,000 inhabitants?

The British Government has enormously ameliorated the condition of the Hindu since the country lay bleeding under a decaying Mogul Empire, or was the victim of organised plunder by the Mahrattas; the native does certainly value English uprightness, its hatred of oppression, of bribery and corruption, its respect for his particular creeds and usages, yet he would certainly prefer to be governed according to Oriental, and not to Western ideas.

There are many reasons to apprehend that, on account of the profound difference existing between these two opposite conceptions of life, Eastern and Western, an extensive Europeanisation of India can only be harmful.

The Russians deal with their Oriental subjects in a rather patriarchal style; they are content with a superficial supervision on exclusively bureaucratic lines, they neglect to do much for the material prosperity, and let things drop without much ado. They do not succeed in reconciling the Orientals to their rule, and even in recent times some attempts at Russification have provoked considerable hatred amongst Russian Armenians in the Caucasus; they do not succeed, either, in maintaining peace among different races hating one another.

It is very remarkable, that whilst in the United States of America, under the rule of free institutions and every kind of liberty, permitting an unrestrained development of any peculiarities proper to the very heterogeneous composition of American society, the assimilating power of the American spirit (Americanism) remains extraordinarily strong, under an opposite rule of absence of liberty, of coercion, and restrictions

imposed on the development of indigenous peculiarities, the assimilating power of the dominant race decreases, and each heterogeneous group tends rather to separation. The Americans, so unlike Orientals in all respects, are beginning to exercise a powerful influence upon the Eastern nations; they have contributed to the reform in Japan, to the arrest of the anti-foreign movement in China, and they have made a good start in the Philippines. How well they appreciate the gravity of their influence in the Eastern world may be judged from the work of Henry C. Morris, *The History of Colonisation* (1900), in which, on the occasion of the annexation of these islands, the author says, "A new problem arose, perhaps more vital to the conquerors than to those whose allegiance was so unexpectedly transferred; the solution of the many perplexities involved in the possession and management of this group (of islands) will long require the gravest consideration on the part of the wisest statesmen present and to be."

The French have a great gift for the initiation of new ideas and new discoveries; the world at large owes them in this respect a great debt of gratitude, but they are not colonisers, and their direct influence on the native populations in the Near and the Far East has never been considerable nor particularly beneficial. Mr. J. Verschuur, in his interesting work about the colonies (*Aux Colonies d'Asie et dans l'Océan Indien*, *S.G.M.*, vol. xvii. p. 222), severely criticises the French mode of administration.

Intolerable customs restrictions, incessant changes of administrators, the laxity with which officers of the colony are chosen, the absence of special training for their duties, the insufficient pay they receive, the excess of leave which enables them to revisit at comparatively short intervals their beloved Paris, from which they return to the East with reluctance and repugnance, are all influences against success.

The Dutch way of dealing with Orientals has been very well explained in recent issues of the *Scottish Geographical Magazine*, in a series of papers about the colonisation of Java.

German action in the East grows in importance. Germans have long ago founded colonies in Russia, they have been its first teachers in its Europeanisation; they have taken recently a leading part in the international expedition to China, they send their military instructors with their guns into Turkey, they obtain concessions for railways, they increase their commerce with the East: that notwithstanding, their civilising influence on the Eastern nations is limited, they generally abstain from proselytising, and acknowledge that their moral right to their natural future is conditioned by the ratio in which they stand towards the East in the matter of give-and-take.

On the whole, the relations between the Eastern and the Western world are far from satisfactory; there is too much presumption of superiority on one side, and too much mistrust and illwill on the other —there is much misunderstanding.

Conclusion.—The present writer has endeavoured, though very imperfectly, to trace the essential characteristics of the Eastern mind and institutions, as opposed to Western characteristics; he has tried to

demonstrate that the origin of the distinctions separating Oriental and Western civilisation are due to many natural and historical causes, and he would now like to conclude with the assertion that the Eastern ways and ideas are quite as reputable as Western ones; that the Oriental world must be governed through Oriental ideas, as the Western world is governed through ideas that are proper to it. Both large groups of humanity, thinking and acting on opposite grooves and lines, have equally deserved well of progress and humanity; taken separately, each of these groups presents the but imperfect and only partially successful efforts of humanity to issue from the struggle for existence with a better lot for the greatest numbers, to increase the happiness and to diminish the misery of existence. The Western world, notwithstanding its preponderance, has no right to be presumptuous; in its dealings with the Orientals it is obliged to seek points of agreement, not of antagonism, the empire of the mind through the heart placing itself alongside all a people holds dear.

Only through mutual respect, through a large toleration and goodwill, in common accord and agreement, can humanity ever succeed in alleviating its sufferings, getting rid of misery, and evolving a happy lot, not for the chosen few at the expense of others, but of all for the benefit of the whole.

THE ANTARCTIC PROBLEM.

At the Anniversary Meeting of the Royal Geographical Society on May 22, Sir Clements Markham, the retiring President, delivered a valedictory address, which appears in full in the July number of the *Geographical Journal*, and of which we have been courteously furnished with an advance proof. In this address Sir Clements reviews the work of the Royal Geographical Society during the twelve years of his presidency, laying special stress upon the progress of discovery during these twelve years, of which he gives a summary account, and ending with a discussion of the light cast upon the unknown Antarctic area by the recent expeditions, especially that of Captain Scott and his companions. In view of the account given here last month of the scientific results of this expedition, it may be of interest to summarise here Sir Clements' views as to the probable shape of the Antarctic continent.

Sir Clements in the first instance recalls the fact that in the Victoria Quadrant (90° E. to 180 E.) there are four masses of land along the Antarctic Circle. These are Adelie and Côte Clarie, Sabrina Land, Knox Land, and Wilhelm II. Land, which rest on a shallow plateau with soundings of 250 fathoms. Sir Clements appears to doubt the view that these lands are connected and form the northern coast of Victoria Land. He rather favours the idea that they are volcanic islands on the edge of the comparatively shallow plateau, and that the north coast of Victoria Land also rises from this plateau, but at a distance of 200 or 300 miles south of Adelie Land.

In the Enderby Quadrant (90° E. to the meridian of Greenwich) Sir

Clements is disposed to believe that Enderby Land and Kemp Land are the same. The distance between Wilhelm II. Land and Kemp Land is about 500 miles, and if there is no land between the two this would, in his opinion, be an additional reason for believing that the coast of Victoria Land trends south of west beyond North Cape, and does not turn northwards to connect itself with Adelie Land.

As regards the mountainous eastern coast of Victoria Land, investigated by the members of the *Discovery* Expedition, Sir Clements holds that there is no evidence for the suggestion that the mountains curve to the east beyond the point seen by Captain Scott and his companions, and unite with Edward VII. Land, while he considers that there is much to be said for the view that they sweep to the southward and unite with Graham Land, thus connecting the Andes, with which system Graham Land is apparently connected, across the South Pole, with New Zealand.

But, as has been already pointed out here, the warm southerly winds experienced by the members of the *Discovery* Expedition are important factors in connection with the distribution of land and water, and Sir Clements goes on to discuss the question whether they are or are not to be regarded as föhn winds. He says:—

"The föhn winds of the Alps and of the west coast of Greenland are dry winds, because they come from over mountains. A moist wind would come from a distant sea. On the west coast of Greenland the föhn winds are south-east winds coming from the Atlantic, where the Gulf Stream preserves a winter sea-temperature of 41° Fahr. Coming from the warmest part of the North Atlantic, and having the shortest distance to pass over the lofty ice-deserts of the interior of Greenland, the föhn increases its temperature in descending to the west, and comes down to Upernavik with a temperature of 42° to 50° Fahr. This föhn wind starts from the Atlantic at 41° Fahr., crosses 400 miles of Greenland ice-cap at heights of 6000 to 7000 feet, and then descends to the west coast. An alpine föhn is calculated to lose $\frac{1}{2}$° Fahr. for every 180 feet that it rises on the south side of the Alps, and to gain $\frac{1}{2}$° Fahr. for every 180 feet that it falls on the north side, where it descends as a warm and dry wind.

"The warm and snow-laden winds from the south experienced at the winter quarters of the *Discovery* are not, therefore, analogous to the alpine or Greenland *dry* föhn winds. They are reported to be damp, laden with snow, and, if this is so, they have not passed over mountains. They were oftener from the south-west than from the south, but this is accounted for by deflection caused by the coastline. Winds from the lofty inland ice-cap to the west come over in an upper current, as was shown by the direction of smoke from Mount Erebus, and do not descend to the surface.

"We must, therefore, seek for the cause of the high temperature of these southerly winds from some other cause, and not from the winds being föhn winds. The north winds, which were very rare, were comparatively warm, because they came from the ocean to the north. The south winds may be warm from the same cause. They may blow from the ocean beyond the Pole—that is, from the Weddell Sea. The Great

Barrier may, therefore, end on the other side of the Pole with another line of ice-cliffs facing the Weddell Sea. It fills up a comparatively shallow rift between the Victorian and Edwardian ice-masses, whose ice-fields continually feed it through their glacial openings. It is also fed by the annual snowfalls. Its length may be 1000 to 1200 miles, possibly more. On the other hand, there may be low land intervening between the ice-barrier and the Weddell Sea.

"The passage of the winds over that distance of ice-barrier with great velocity would not lower their temperature. The experience of the *Alert* exemplifies this. The föhn wind, with a temperature of 46° Fahr., after descending to the sea-level on the west coast of Danish Greenland on November 25, was at the *Alert's* winter quarters on the 26th, a distance of 1300 miles over ice at sea-level, raising the temperature several degrees. The Antarctic south winds, starting at a high temperature from an open part of the Weddell Sea, would blow along the whole length of the barrier and reach the *Discovery* in twenty-four hours or less, both warm and snow-laden. These south winds seem to indicate that the other end of the barrier may be an ice-cliff facing the Weddell Sea.

"But a serious doubt is thrown upon this theory by Mr. Shaw. He suggests that the snow coming with the south winds may be carried along in a surface drift, and remarks that the wind, in intense cold, can hold very little moisture. On the other hand, observers on the spot are confident that heavy falls of snow came with the southerly winds, and they were warm, not cold, winds.

"The very extensive flat-topped icebergs of the Antarctic seas are too large to come from land glaciers, or from ice-cliffs resting on land. They must be the product of the 400 miles of ice-cliff terminating the barrier on the side of the Ross Sea and on the side of the Weddell Sea."

As to the relation of Edward VII. Land to the other land-masses, Sir Clements Markham goes on to say that the northward trend of this land points to Captain Cook's furthest in 71° 20′ S. and 106° 54′ W. In the near neighbourhood of this spot, where Cook thought he saw land, is the position assigned by the Russian expedition of 1819 to Peter I. Island. From this point the coastline is indicated by the line of the submarine plateau discovered by the *Belgica* from 75° to 103° W, which is only 270 fathoms below the surface, with an abrupt descent on the north side to 800 fathoms. The north coast of Edward VII. Land would run parallel to the line of this submarine plateau, perhaps 100 miles or so to the south, and the coastline would then turn towards the south to join with the side facing the barrier.

If these hypotheses are correct, the Antarctic area would consist of two land-masses of unequal size, Victoria Land and Edward VII. Land, separated by the Great Barrier, and of two seas extending far to the south, the Ross Sea and the Weddell Sea.

As regards the Weddell Sea, Sir Clements is disposed to believe that Graham Land is a large island, and that the land discovered by the *Scotia* Expedition is similarly insular and not a part of an Antarctic continent.

THE DEPRESSION OF SISTAN IN EASTERN PERSIA.[1]

By Ellsworth Huntington.

Windy Sistan, once the proud home of Rustum, the Persian Hercules, is a poverty-stricken district near the distant corner where Afghanistan and Baluchistan join Persia. A variable lake and a swamp occupy the lowest portion of a mountain-girt basin five hundred miles in diameter; while adjacent to them on the east lies habitable Sistan. The lake is a shallow body of clear water, very slightly saline. Its size varies from almost nothing in times of drought to a diameter of sixty miles or more during floods. Both extremes are sometimes reached in a single year. The maximum depth does not exceed ten feet, according to the statements of the inhabitants of the shores, who pole their rafts to all parts. The swamp, which lies chiefly east and south of the lake, and is gradually encroaching far into it, consists of a dense growth of feathery-topped reeds from five to ten feet high. Outside the swamp comes the most important part of Sistan, an arable plain of fine silt and clay left exposed by the withdrawal of the water during the gradual drying up of the lake. On the borders of what was formerly the lake-bed rises a rim of steep bluffs from fifty to four hundred feet high. Their level tops form the edge of a barren plain, a desert of sand and gravel which completely encircles the inner, better-watered regions. To the west the desert, composed wholly of naked gravel, is only a few score miles in width: to the east, more sandy and silty, it stretches hundreds of miles, broken only by the narrow green depressions of the Helmund and other rivers. Lastly, outside the desert, rise the mountains, shutting their remote basin from the outer world. Those on the west and south are comparatively dry, and furnish no perennial stream; but on the north and east the perpetual snows of lofty Hindu Kush give rise to countless rushing brooks and rivers. Of all these only one, the Helmund, is always able to endure the aridity of the inner basin and reach Sistan perennially.

The varied zones of the basin of Sistan—namely, the lake, the swamp, the arable plain, the encircling desert, and the surrounding mountains—present physiographic types of the utmost diversity; it is to be expected that in response to such environment animate nature will present equally diverse autographic types. In a region of extreme aridity, such as Sistan, the relief of the earth's surface is the main factor in determining the presence or absence of water, and hence of life, both vegetable and animal. In the Sistan basin an abundant water-supply is found on the edges among the high mountains, and in the centre, Sistan proper, which may be defined as the area anciently covered by the lake during its last notable expansion. In these two regions, therefore, life is abundant; while in the far greater area covered by the intervening desert it is very scarce.

The mountains west and south of Sistan lie one or two hundred

[1] Reprinted from the *Bulletin of the American Geographical Society*. Cf. also map, *S.G.M.*, vol. xviii. p. 211.

miles from the lake. They reach heights of from five to ten thousand feet, and are covered with snow in winter. In early spring they produce a growth of short, sweet grass, excellent for sheep and camels. In summer, however, the grass dries up, the springs vanish, the running streams disappear or contract and become bitterly salt, and neither man nor beast can live. The human inhabitants of the region are of necessity nomads, dwelling in tents and journeying from place to place with their flocks. On the advent of a dry season they reluctantly leave the relative coolness of the mountains and migrate across the parched desert zone to the vicinity of the lake. Sistan is a fearful place in summer; but water abounds, and there are smooth plains of grain and grass to support man and beast. It is a "hell full of bread," as the people say; but that is better than the starving heaven of the mountains. Thus a considerable portion of the population of Sistan consists of nomad Baluchis driven in by drought from the surrounding mountains and deserts. Some have settled in permanent villages as agriculturists; but the majority wander from place to place, going to the cool mountains or the healthful desert whenever there is sufficient grass and water.

The other human inhabitants of Sistan are more permanent. Part of them, the Sistanis, are agriculturists, inhabiting chiefly the delta of the Helmund River. The rest are a peculiar people, the so-called "Fowlers," or Sayads, who inhabit the swamp. Our habit of regarding deltas as smooth plains makes it seem almost absurd to speak of the relief of the delta of the Helmund as having a determining influence upon the conditions of life. Yet such is actually the case. To the eye the delta appears flat, but careful observation shows that, like others of its type, it consists of low, broad ridges, perhaps five or ten feet high and several miles broad, with corresponding hollows between. A main distributary of the river flows along a given radius, and during floods deposits silt, especially upon the inner portions of its flood-plain, until the stream flows on the top of a broad, smoothly-arched ridge, very flat, but very real. Then, during some flood, the stream breaks from its old course and follows a new radius, along which another ridge is built. The ridges of the Helmund delta can easily be detected, not by their relief, but by the character of their vegetation. They are dry and barren, with few plants except the prickly camel-thorn, a bushy weed with small reddish-purple flowers. Villages are rare, and animals of any sort are almost absent. Sand-dunes abound, and are gradually encroaching over the whole area. The soil is rich and easily tilled; but most of it is now left unutilised, although abundant ruins show that this has not always been the case. The reason is not far to seek: the rainfall of Sistan is very light, and is limited to the winter months. Agriculture is utterly impossible without irrigation. It is an easy matter to lead water along the ridges in canals; but it does not pay, for the few feet of extra elevation raise the surface of the soil too far above the level of permanent underground water maintained by the lake. The roots of the plants cannot reach it. Hence more water is required for irrigation, and a drought is much more disastrous.

In the hollows the case is different. Where they are subject to

flooding by the rivers in spring a dense jungle of tamarisks grows up to a height of twenty feet or more. It is frequently so dense as to be impassable, and furnishes splendid cover for unnumbered jackals, wild boars, and other smaller animals. The people realise that water is close below the surface, and clear away the jungle for fields of millet, which grows luxuriantly along with the feathery young shoots of the quickly-sprouting tamarisk. Other hollows, not subject to inundation, are completely cleared and highly cultivated; and they, with the low-lying borders of the delta, are the places where grain grows best and men congregate most thickly. In winter and spring it seems as though the people of Sistan had chosen the most marshy, unhealthful, and impassably muddy portions of the delta for their villages; but they have merely done what sad experience has taught them to be essential—located themselves where the roots of their crops can reach a perennial water-supply during the protracted dry season.

The irrigation system of Sistan is crude but, on the whole, effective. Every autumn, when the Helmund River is at its lowest, the Persian Governor, who controls most of the region, calls out a large part of the male population. Tamarisks, cut in the jungle and bound into great bundles with their own branches, are brought on the backs of men or donkeys and piled into the diminished river at the head of the delta. Bundle is tied to bundle, and the whole is plastered with clay, forming a porous but fairly effectual dam. All through the planting season of winter and the vegetative season of early spring it diverts the water into a labyrinth of sluggish canals, which make travel a torture in the flat plain. Then, in May, comes the great flood from Hindu Kush, and the flimsy dam is swept away. But the people do not care. The crops are almost grown, the remnants of the dam divert enough water into the canals for drinking purposes, and, when the time comes, the Governor will compel somebody—not them if they can help it—to build a new dam.

The flatness of the inhabited portion of Sistan causes the water to spread over very wide areas whenever the fields are irrigated. This, added to the depth of the canals and the slipperiness of the clayey soil, makes travelling wellnigh impossible in winter—a state of affairs which might be avoided if the aridity of the country did not compel the location of villages in the flattest, dampest places. The people are so accustomed to mud and water that even in freezing weather they wade unconcernedly through canals and rivers or through the water standing on roads and fields, and suffer fearfully from rheumatic complaints in consequence. Where a canal is too deep to be easily forded primitive bridges are constructed. As wood is very scarce, dry, bushy camel-thorn is thrown into the sluggish water and packed down until a firm but very porous dam is formed. A foot or two of clay is spread upon the camel-thorn, and a dry road is constructed. Such a bridge is easy to cross, and does not greatly check the slow flow of the water. Often the flimsy structures are so strong that even horses and camels can cross them, although, if the path is very narrow, difficulties ensue. One of my camels slipped off the path and fell with his front feet hanging over a bridge upstream

and his hind feet downstream. We were obliged to dig away not merely the bridge but part of the bank of the canal—a performance which the people seemed to regard as quite commonplace. In one case I saw a very broad bridge, which not only furnished an excellent pathway, but carried one canal directly across another.

In addition to the muddy roads and flimsy bridges, the aridity of Sistan produces other strange results. For instance, during the floods of the spring of 1904, a number of people were drowned because the water had been so low the previous winter. At that time the Helmund actually became dry. Fortunately, water could be obtained easily by digging wells, and no one suffered from thirst. The easiest places to dig wells were in the deep beds of the streams, for there the water was only a few feet below the surface. The most accessible parts of the stream-beds were at the fords, directly in the course of the everyday paths. So there the careless Sistanis dug their wells; and, when the water was high the next spring, walked into them and were drowned.

The lake and swamp of Sistan support more abundant life than do the plains. The vegetation is chiefly reeds and the low grass on which the Baluchi nomads feed their cattle. Among animals shell-fish and fish were formerly abundant, but are now scarce, having perished in great numbers during the almost complete drying up of the lake in 1871, and again in 1903. Insects and small animals of various sorts are abundant, as is evident when the swamp-men burn off the reeds for the sake of their cattle. The first fires that we saw appeared as immense columns of black smoke thirty miles away. Later, close at hand, we saw the fluffy heads of the reeds blazing up suddenly with a red flash and a sharp crackle almost like an explosion. The air in front of the flames was full of ravens, kites, crows, hawks, and other birds, which pounced now and again on the hapless little beasts and insects driven from their homes by the advancing heat. Behind the fire, where the ground had become cool, other birds were picking up the insects killed by the flames. The birds of Sistan are innumerable. During January we saw the water dark with thousands of them—coots, ducks, geese, pelicans, plovers, sand-pipers, grebes, swans, and others. Early in February they were beginning to leave, presumably on their way to the lakes of northern Europe or Siberia.

The strangest dwellers in the swamp are the people, the ancient race of Sayads, or Fowlers. They are of the purest Persian stock, and appear to have preserved the same mode of life unchanged for ages. Their houses are made of reed-matting, their cowsheds of bundles of reeds, their heavy canoe-shaped rafts of more tightly-tied bundles of reeds, their fuel is reeds, and the food for their small, humped cattle is reeds. In fact, their whole life has adapted itself to an environment of reeds and swamps. When the Government sends for taxes they are said to know how to lose themselves and their cattle in the swamp as if by magic. If a stranger builds a raft upon the lake they attempt to destroy it by night, for they claim the water and all that pertains to it as theirs. Most of all, the birds are theirs. Each winter evening, in the sunset glow, a fleet sets forth from every village; men in blue or

brown, with sturdy, naked limbs, stand on their golden rafts and pole them out over the grey-blue water to the fringe of yellow reeds. Nets are stretched on sticks half-overhanging the water, and the men hide themselves in the rushes. A duck, a coot, or a swan, swimming under a net, strikes it unwittingly; the Fowler pulls a string, the net falls, and the bird is entangled. The Sayads own fields of grain in many places, but their chief source of livelihood is swamp-fed cattle and swamp-caught birds.

Thus three types of men live in Sistan—the nomad Baluchis, the agricultural Sistanis, and the swamp-haunting Sayads. The Baluchi is a nomad because his mountains and deserts cannot support him permanently in one place. Therefore he wanders with his flocks, and makes his tent of easily-obtained portable cloth of goats'-hair. Being compelled by drought to come to Sistan, he is in part losing the nomadic habit and settling in villages. The Sistani is a settled tiller of the soil, because in no other way can a large population exist in Sistan. He uses the dry camel-thorn for fuel because it is nearer at hand than the tamarisk of the jungle, and he needs no fire except to cook his bread. He builds his house of mud, with a domed roof without a particle of wood, because good, stiff clay for sun-dried bricks is abundant, while wood large enough to serve as timber is almost unknown. Yet his brother of the same race, who lives in the jungle, builds his house of interwoven tamarisk boughs wattled with mud. The jungle man is also agricultural, but he moves from place to place every few years. It is easy to build a new house of his flimsy variety, and it is as hard in one place as in another to keep the tamarisks out of his fields. The Sayad once more is a nomad, because his humped cattle must be driven to new reed-beds; but he need not move far, for fodder is easily procurable in large quantities. Young reeds grow fast when the ground has been burned over, and old reeds are so large that cattle eat them slowly. Nor does he need to carry his house and stable with him, for if there are plenty of reeds a day's work will make a new house. Moreover, he cannot migrate far, for he must be near his fields on the outer edge of the swamp, and he must be where he can always go for waterfowl on the inner edge.

The wind, like the other physiographic features of Sistan, has a marked influence upon life. During three months of the summer a remarkably constant wind blows night and day with great violence from the north-north-west. It seems to be the northward continuation of the trade-winds deflected to the west by the prevailing trend of the mountains. It is said to blow at a rate of over sixty miles an hour for days at a time without intermission. Its violence is such that the air is thick with flying sand; and huge sand-dunes are formed or blown away with almost the rapidity of snowdrifts. At Chil Per, near the great ruins of Zahidan, I saw a sacred shrine located on the borders of the dune area, but entirely free from sand. A few months earlier, when the place was visited by Colonel MacMahon, of the Sistan Arbitration Commission, it was completely covered with sand, which—so the natives say—was blown away in three days after the summer wind began to blow. No

trees, except the tamarisk, can flourish in Sistan unless carefully protected from the wind. On the north-west border of the region, however, where the gorge of Bendun affords a shelter from the wind, fine palm-groves are the main support of the villagers. Even low-growing plants are influenced by the monotonously fierce gales. The vine of the wild water-melon, a bitterly acrid little fruit, most delicately striped with green and yellow, does not spread in all directions, according to its normal habit, but is blown into a tangled, closely-packed rope of stems extending south-south-east from the root and so uniformly oriented that it might serve as a compass.

In spite of its disadvantages, the wind is of use to the people of Sistan. It grinds their grain and makes life livable in summer. In the houses of the rich extra doorways are built in the north wall. In winter they are walled up with sun-dried bricks of mud; in summer they are opened and stuffed with brush. A servant standing outside throws water upon this. The wind whistling through is cooled by evaporation, so that, although the outside temperature may be over a hundred degrees, the interior sometimes becomes too cool for comfort—until the servant falls asleep and the burning blast sweeps in uncooled. When the wind dies down for a day or two the extreme heat is as nothing compared to the plague of the countless mosquitoes bred in the swamp.

Sistan deserves to be called a hell. A fly, like the tsetse of Africa, kills the horses; the dogs die of a peculiar epidemic which leaves the survivors blind; the camels are subject to two virulent contagious diseases. During January 1903 the transport camels of the British Arbitration Commission were dying of influenza at the rate of from twenty to fifty a day. As we approached the camel camp groups of villagers appeared—one with camel-leg slung on his donkey, another with a rib over his shoulder, and a third with a liver on his back. At the camp scores of men were waiting for the suffering camels to die, when they hauled them out of the compound with ropes and chopped them to pieces with axes. The poor Sistanis get so little except bread and melons to eat that any flesh is a boon. They ate every part of the diseased camels except the bones and skin.

Yet Sistan is rich in possibilities. Even under the present oppressive conditions of government it exports large quantities of grain. It is a prize for which four nations are struggling. England and Russia desire influence; Persia and Afghanistan desire actual possession. In both cases the struggle is a geographic response to the peculiar character of Sistan as a fertile depression in the midst of a desert. Russia wants her influence to be supreme, because Sistan is the only promising half-way house on the most feasible line of railway from Transcaspia to the Indian Ocean. England, in the same way, wishes to be paramount, because Sistan is the only half-way house from India to Western Persia. On every side stretch deserts, a month's caravan journey in width. In the middle Sistan furnishes a resting-place, with abundant water and supplies. The power that holds it has a priceless military advantage over its rival.

To-day Sistan is divided between Persia and Afghanistan in defiance of physiographic facts, and hence there is a continued and often sanguinary struggle. The water-supply comes wholly from the Afghan mountains, and the easiest line of approach is across Afghanistan down the main rivers. The strip of desert west of Sistan offers a natural boundary between Afghanistan and Persia. In a few places it is narrow and easily crossed; elsewhere it forms an almost ideal international barrier. An Afghan caravan which had crossed the desert north of Sistan in search of salt related that four or five men had died of hunger.

"Had the rest of you no bread?"

"Yes, but we feared that if we gave it to our friends we ourselves might suffer. That is the rule of the desert; each man for himself."

A desert whose horrors engender such heartlessness would seem to be an effectual barrier between nations. While the boundary between Persia and Afghanistan defies geography and passes through Sistan, the two nations cannot be expected to live at peace.

Thus far we have considered a few of the many ways in which the physiography of Sistan influences the life of to-day. A complete study of the geography of the region must include also the influence of physiography upon life in the past. Tradition, historical record, and the distribution of ruins unite with the freshness of the abandoned lake bluffs in suggesting that within historical times the water-supply of Sistan was greater than now. One or two thousand, or even five hundred years ago, this region, which is now so poverty-stricken, was most prosperous. According to Lord Curzon, the number of ruins in Sistan is probably greater than in any equal area in any part of the world. The former population must have been far more dense, and at the same time more prosperous than that of to-day. It seems probable that the decrease in the water-supply, on the one hand, and the impoverishment and diminution of the people on the other, bear the geographic relation of cause and effect.

THE ALEXANDER-GOSLING EXPEDITION.

We have recorded here from month to month the progress of the expedition undertaken by Lieutenant Boyd Alexander and Captain Gosling to Nigeria (*cf.* the April issue, p. 214).

Dispatches written early in February at Maifoni—the village to the south-west of Lake Chad where Captain Claud Alexander succumbed to enteric—have recently arrived in this country with further news of the expedition. These letters give an account of the journey undertaken by Lieutenant Boyd Alexander last year from Loko to Yo. It appears that, having had occasion to return from the camp at Ibi to Lokoja, he determined to journey separately to the Yo river, marching overland and deviating from the beaten tracks as far as circumstances would permit. A start was made in July from Loko, a town on the northern bank of

the Benue about 100 miles from the junction of that river with the Niger. Following a northerly route, the traveller came to Nassarawa, a large town and a centre of Fulani and Hausa trade. As the town was approached the scenery became more interesting. Here and there the flat, bush-covered country, with its tropical river belts, gave place to rugged, cone-shaped hills clothed with trees, while far away to the north, showing faintly blue in the distance, loomed out the hill-country beyond Keffi. The latter town was reached five days out from Loko. It is surrounded by a massive mud wall over two miles in circumference, a large part of which is now, however, in ruins as a result of the trouble at the time of Captain Moloney's murder. The British administration is represented in the town by a Resident and a police-officer.

It was not to be expected that British intervention would at once be viewed with favour by the ruling Fulani class. Lieutenant Boyd Alexander's observations and inquiries led him to the conclusion that the Fulani do not like the British. One direct result of the establishment of British authority has been a considerable diminution of the wealth of the Fulani, consisting, as that wealth did, mainly in slaves and flocks. Formerly as many as from five to six thousand slaves were sent annually to Sokoto and there sold to Tripoli merchants. That traffic has, of course, now been very largely, if not entirely, suppressed. What, however, helps to reconcile the Fulani to British rule is the widespread conviction that it will soon be withdrawn—that the white man will tire of the country, and the day will arrive when he will pack up his baggage and depart. This, according to Lieutenant Boyd Alexander, is the daily prayer of the Fulani. In close connection with this state of feeling is the present activity of the Senussi sect, which Lieutenant Alexander reports to be very marked in many districts, notably around Kuka, near the south-western shore of Lake Chad. The ancient prophecy that Fulani rule would be predominant for a hundred years, and that it would then be overthrown by a white people, has come true. Now it is being preached that the limit of British ascendency is four years. The danger, from the British point of view, is that such prophecies have a tendency to produce the men who will attempt to fulfil them. At the same time, Lieutenant Boyd Alexander is of opinion that the spread of Fulani influence throughout Nigeria is less extensive than it is sometimes thought to be. It is practically confined to the plain, where the Fulani found the conquest of the tribes a comparatively easy matter. The hill country is inhabited by savage Pagan tribes who have always retained their independence, among whom the extension of British influence will be a work demanding much time and patience. In the lowlands the Fulani conquerors have lost many of the characteristics of the shepherd race from which they are sprung. When they established their authority the Mallums (priests) everywhere founded schools for the propagation of the Moslem religion, and the faith quickly spread. But the chiefs became rich in horses and cattle, and abandoned themselves to a life of settled ease. Intermarriage followed between conquerors and conquered, and the present race of Fulani, cross-bred with Hausas and Pagans, differs materially from the original stock. Evidence of

what the Fulani were probably like when they first entered the country is still to be found, however, among a small and dwindling section of the race known as the Bush Fulani. Living entirely in the bush, these people travel in small bands, driving their flocks from one district to another, according to the season and the supply of water. Retiring and shy by nature, they seldom approach the towns, but on certain days hold small bush markets for the sale of their milk and butter to the neighbouring villagers. At present they refuse to recognise silver as a medium of exchange, and will accept only cowries in payment. They are nomadic in appearance, and eye strangers with timid, furtive glances. The women are tall and handsome, pale-skinned, with oval faces; they wear large, massive brass and silver earrings, which, however, are half hidden by thick twists of silky hair reaching to the shoulders.

On leaving Keffi Lieutenant Alexander branched off from the main road and followed a north-easterly route to the town of Dorroro, situated at the foot of a lofty range of hills which form the stronghold of a fierce Pagan people, the Kagoro tribe. These people are head-hunters of the worst type, and, from Lieutenant Boyd Alexander's description, appear to have some points in common with the Dyaks of Borneo. Their country has still to be penetrated and explored, but, continuing his journey from Dorroro, Lieutenant Alexander was able to reach a border village named Petti, lying to the east of Katab. The village was built on the sides of a high, rugged hill, and the paths leading to it were the merest hill tracks, following a very steep and devious course among the rocks. A number of small mud-houses, cemented to projecting crags, composed the stronghold. These huts were squalid in the extreme, with doorways so small that the inmates had to crawl out on hands and knees. A narrow gangway ran down the centre, and the front portion was partitioned into cubicles, where slept the younger members of the family. Lieutenant Alexander reports that the Kagoro men, like most of the Pagan tribes, are strongly built, with thick-set, unrefined features, showing a marked resemblance to the tribes which had been visited to the south of the Benue river. They are keen hunters, fight with poisoned arrows, and ride small hill ponies, on which they get about very quickly. Tin is known to exist among the hills, but it is only on the borders of the Kagoro country that it can be worked at all, and it is not surprising to learn that mining is practically at a standstill. To the west of the Kagoro country are the Kachia and Panda Hills, a low range only some 800 feet in height, constituting the watershed between the Gurara and Kaduna tributaries of the Niger. Here are found Pagan tribes of an even lower type, apparently, than the Kagoro.

Lieutenant Boyd Alexander's journey through this region was made at the height of the rainy season, and, as the country is well watered, travelling presented many difficulties. Rivers had constantly to be forded, and at several points rough bridges had to be constructed. Eventually Bauchi, away to the north-east, was reached on September 8. The Emir of that important centre maintains a considerable show of state. Lieutenant Alexander gives an interesting account of the ceremony attending his interview with this potentate.

From Bauchi Lieutenant Alexander followed a little-known route to the Gongola, travelling by way of Goram, Kufa, and Ako. The roads of this district, he found, had already been accurately mapped. The towns contain a mixed Fulani and Hausa population, and at Mamaidi Lieutenant Alexander was afforded an opportunity of witnessing for the first time the Hausa wrestling. This he describes as a most striking performance. The contests are adopted as a means of settling certain classes of disputes, and are held by order of the local chief. What greatly astonished Lieutenant Alexander was the points of resemblance in the performance to wrestling as practised in Europe. Umpires were appointed, the combatants shook hands before commencing, and the wrestling itself was in the Greco-Roman style. The Fulani do not practise this wrestling, nor do any other of the natives of the country.

On October 8 the Gongola was reached at Ashaka, where, it may be remembered, other members of the expedition had been earlier in the year. Thence Lieutenant Alexander made his way *via* Gujiba to Gaidam, on the Yo river, and followed the road along the southern bank to the town of Yo, near the shores of Lake Chad. A good deal of trouble is being caused by the Mobbur and Tubu tribes along the lower reaches of the river, which now, under the Anglo-French Agreement of last year, constitutes the frontier between the British and French possessions in this part of its course. But the whole district is just now in an extremely unsettled condition.

During the extended stay of the expedition in the districts immediately to the west of Lake Chad much interesting information has been acquired concerning both country and people. In particular, extensive collections of mammals, birds, and fishes have been formed. On February 3 Lieutenant Alexander proposed definitely to renew the journey across the continent. The expedition, it was intended, would make its way up the valley of the Shari and then strike across to Mahagi, on the shores of the Albert Nyanza. It was hoped that it would be possible to make extended use of the two steel boats, which up to that time had been of the greatest possible service. Mr. Talbot having returned to this country, Captain Gosling and the Portuguese collector are now Lieutenant Alexander's only European companions.

GEOGRAPHICAL NOTES.

Europe.

Erratum: Rainfall of the Ben Nevis Observatories.—In the note on this subject in our last issue (p. 329), it is stated by a misprint that the summit rainfall is 106·78 inches, whereas, as the context shows, the figures should read 160·78 inches.

Asia.

The Kirghiz Steppe.—The Kirghiz Steppe, though a uniform area for the ethnographer, from the point of view of physical geography can

be divided into three regions, the typical steppe, the region of lakes and rivers, and the region of hills. The typical steppe is very uniform over vast areas, the scenery being throughout monotonous, though impressive on account of the absence of natural boundaries and the consequent feeling of vastness produced. In spring when the ground is watered by the melting snow and the warm rains, it is covered by a rich carpet of vegetation, whose wealth of fodder plants feeds vast flocks and herds. Species are relatively few, the dominant plants being represented by countless numbers of individuals. These dominant plants are the feather-grasses (*Stipa pennata* and *Stipa capillata*), fescue-grass, various species of wormwood, and lucerne. As in many places one of these species prevails over vast areas to the practical exclusion of others, it is common to name areas of the steppe from the dominant species: thus we have wormwood steppe, feather-grass steppe, and so on. In addition to the dominant plants named above, a considerable number of others occur, many peculiar species being found. Forests are rare in the steppes; a few fir-woods occur, there is a peculiar species of ash, as well as species of poplar and willow. There are some interesting and characteristic shrubs, of markedly xerophytic and halophytic habit, notably species of Spirea, Caragana, and Haloxylon. As regards animals, the steppe is singularly rich in birds, especially in passerine forms. There is only one kind of song-bird, the larks, but they are present in literally countless numbers. It is interesting to note that not only are the plants of European Russia beginning to encroach upon the indigenous plants of the steppe, but some of the birds are doing the same thing. Thus it is stated that the ubiquitous sparrow first appeared in the steppes about the middle of last century at the time when the region was being colonised by Russian peasants.

The true steppe is poor in running water, and indeed, except in spring, in water of any kind. In the second region of the steppe, however, the region of lakes and streams, there are numbers of lakes, some permanent, some becoming dried up in summer. Here also there are four or five permanent streams, all the others drying up in summer, their beds being then occupied by scattered pools containing dirty and strongly saline water. In this region both the flora and fauna differ from the typical steppe. The dominant plants belong to the families of Ranunculaceæ, Nymphaceæ, Chenopodiaceæ, and Cyperaceæ. As the very numerous lakes which are scattered over this region are bitter or saline, there is a tendency for the vegetation to pass into the salt-steppe type. All the lakes are characterised by their low banks, and their shallowness as compared with their area. Thus the Kysyl-Kak lake, with an area of 162·5 square kilometres, has a depth of only 1·5 metres. The lakes are further peculiar in having no outlet. All the facts point to their origin from a retreating sea which once spread over the whole of this region.

The third region of the steppes is that of the hills, called by the Russians the region of ssopkas and mjelkofsopotschniki. In this part of the steppe there occur, rising up from the surface of the plain, isolated hills with rounded bases and dome-shaped summits (ssopkas), or

similar hills may occur in chains (mjelkofsopotschniki). These hills are specially to be found in the south-eastern part of the country. They are also to be ascribed to the action of the old sea which covered the region, the hills being composed of Palæozoic rocks, as compared with the younger rocks which form the true steppe. These younger rocks weather down to form rich soil, hence the wealth of vegetation on the true steppe, while the Palæozoic and eruptive rocks which form the hills, though they do not yield good soil, yet are rich in minerals. Coal, lead and silver ores, copper, iron, manganese, and gold all still await exploitation by modern methods. The flora of this region is very different from that of the preceding. A notable character is the prevalence of shrubs, such as species of Cratægus, Spirea, Lonicera, Ribes, Salix, Rosa, Caragana. Trees are as a rule feebly developed, but poplar, birch, and *Pinus silvestris* occur in places.

The climate of the whole area is markedly continental. After the rains of May begins the hot dry summer, when the vegetation becomes rapidly yellow and dried up. The winters, on the other hand, are severe.—*Himmel und Erde*, xvii. 4.

Standard Time for India.—We have received the following from the Under-Secretary of State for India:—"I am directed by the Secretary of State for India in Council to request that the Royal Scottish Geographical Society may be informed that the Government of India have recently had under their consideration, in consultation with Local Governments and Railway Administrations, the question of the advisability of introducing a Standard Time for India, and have decided, with the general concurrence of the authorities consulted, to adopt, for their railways and telegraph offices, a Standard Time, which will be in India (except Burma) 5½ hours, and in Burma 6½ hours, in advance of Greenwich time.

"This change will be brought into effect at midnight between the 30th June and the 1st July 1905.

"The Government of India do not at present propose to extend the new system beyond the sphere of their telegraphs and railways, and will separately consider the application of the new standard to meteorological observations."

America.

The "Sunk Lands" of Missouri and Arkansas.—The region usually called the "sunk lands," in south-eastern Missouri and north-eastern Arkansas, is remarkable as having been in the vicinity of New Madrid the scene of a violent and continuous earthquake in the early part of last century. The first severe shock was on December 11, 1811, and minor disturbances continued at intervals till January 7, 1812, when there was another shock as severe as the first. The fact is the more remarkable in that the district is far removed from the site of any volcano and from the sea-coast. That it is, nevertheless, in an unstable condition is shown by the fact that, even at present, it is rare for a

year to pass without a shock, one occurring so recently as September 1904. At the period of maximum violence described above the shocks were said to be felt at a distance of 200 miles. Among the phenomena observed were the opening of fissures, the formation of lakes and fault scarps, and notably the appearance at the surface through fissures of quantities of sand and of lignite. The causation of these phenomena has been recently studied by Mr. Edward M. Shepard, who in the *Journal of Geology* (xiii. 1) puts forward a simple and interesting explanation. Throughout the area there is a superficial deposit of loess or alluvium, which lies upon a thick layer of impervious blue clay. Numerous Artesian wells in the surrounding districts show, however, that this clay lies upon a water-bearing bed of fine sand, intermixed with lignite, in which the water pressure is high. In the New Madrid area there are numerous streams and lakes, which are fed by springs rising apparently through fissures in the clay from the underlying sand-bed. These springs bear with them a very considerable amount of fine sand, which is deposited as a fine film from a glass of apparently clear spring water when it is allowed to stand. Mingled with sand round about the outlets of the springs are also minute particles of lignite. The suggestion as to the cause of the earth movements made by the author is then simply that the gradual removal of the sand by Artesian water causes the clay to become undermined, until a time comes when the pressure of the underground water is too great for the weakened clay roof. The clay then undulates in great earth-waves and ruptures, discharging fountains of water, sand, and lignite until a new position of equilibrium is obtained.

The Glaciers of the Canadian Rockies.—In the *Journal of Geology* (xii. 8) Mr. I. H. Ogilvie gives an account of a peculiar type of glacier found on the eastern side of the Rockies. The Canadian Pacific Railway crosses the mountains near the fiftieth parallel, and affords an easy means of access to a belt of glaciers within the Rocky and Selkirk ranges. The glaciers here fall into two groups, which lie to the east and west of the watershed respectively, and differ considerably in characters. In the eastern and central group the valley glaciers have few or no névé feeders, but take origin from avalanches from overhanging cliff glaciers above. The avalanches carry down with them great quantities of boulders and rock-rubbish, and the consequence is that the valley glaciers are covered throughout almost their entire length with a thick coating of débris, which protects them alike from melting by the sun's rays and from evaporation. The cliff glaciers above the valleys rest on exceedingly steep slopes, and usually terminate upwards in arêtes, so that there is but little room for the accumulation of snow. The cause of this surface relief is to be sought in the structure of the rocks, which are here composed of hard, unmetamorphosed limestone, with vertical cleavage, which tends on weathering to produce cliffs. Precipitation at this side of the range is moderate, and the sharp relief allows little scope for the accumulation of snow.

On the western side the conditions are different. In the Selkirks

the rocks are schists and quartzites, which are readily rounded, and tend on weathering to produce broad, open, U-shaped valleys, and gentle slopes. There is in consequence a great accumulation of snow, and expanses of névé are produced. The glaciers which emerge from these snowfields are of the same general type as those which occur in Switzerland, and the material which they carry is largely within or beneath the ice, the surface being clear. So far as the amount of precipitation and the other conditions go, everything seems to be favourable to the persistence of glaciers on the western side, and unfavourable on the eastern side. Nevertheless observations show that, with rare exceptions, the western glaciers are rapidly retreating, while the débris-covered eastern ones are retreating slowly or are even advancing. The author believes that it is the protective character of the covering of débris on these glaciers which is responsible for their advance, and even for their continued existence. A point of some interest is that the load of débris consists of angular and talus-like material, and not of scratched and smoothed stones of the type commonly found in moraines.

Renewed Activity of Mount Pelée.—According to a Reuter message from Fort de France, Martinique, dated June 14, Mount Pelée has again displayed signs of activity. According to the telegram, the dome suddenly became illuminated on Saturday, June 10, and on Sunday morning it collapsed, and a mass of mud overflowed into the valley below, while a cloud of vapour rose to a height of 1000 yards.

Australasia.

Surveys on the Eastern Pacific.—In the *Bulletin of the Museum of Comparative Zoology*, Harvard (xlvi. 4), is published a series of letters from Professor Alexander Agassiz describing the sounding expedition of the *Albatross* during 1904-1905 in the Eastern Pacific. A line of soundings was in the first place run from Mariato Point to Chatham Island in the Galapagos, the greatest depth being 1900 fathoms about 100 miles south-west of Mariato Point. The Galapagos Islands appear to rise steeply from the ocean bottom, the 1000-fathom line being not more than 60 miles from Chatham Island. From the Galapagos the soundings were continued to Callao, and at a distance of 80 miles off this place the line dropped into the Milne-Edwards deep, registering a depth of 3200 fathoms. During the voyage a large number of interesting animals were taken in the trawls. From Callao the voyage was continued to Easter Island, and it was observed that the surface and bottom fauna was rich so long as the vessel remained within the Humboldt current, becoming very scanty as this current was quitted. All the observations tended to demonstrate the great importance of this current considered in relation to the distribution of life.

At Easter Island a considerable amount of shore-collecting was done, and the prehistoric monuments of the island carefully studied. The land flora is very poor, and in the dry season the island is singularly desolate in aspect. From Easter Island the *Albatross* returned to

Chatham Island. Hence the voyage was continued to Manga Reva, the principal island of the Gambier group. A very careful study of this group was made. As the result of his survey Professor Agassiz is of opinion that the archipelago formerly possessed a great central volcano, with a deep crater of more than thirty-four fathoms, parts of the rim of which are now represented by Manga Reva and Au Kena. On the west face this great crater must have been flanked by smaller craters, which remain as islets, and there were probably other secondary volcanoes. The flora and fauna of the Manga Reva Archipelago is singularly poor.

From the archipelago the return was made to Acapulco. During this voyage trawling was not attempted until the surface-temperatures indicated that the southern edge of the cold western equatorial current had been reached. Here the surface fauna and flora was rich, and the trawl showed also abundant life on the bottom. This is interesting as showing that in the tract of a great current, with abundance of food, a rich fauna may be found at very great distances from continental lands. Another interesting point is that in the great Humboldt current, wherever it was crossed, diatoms were found to be numerous, showing that the track of a great current can be traced not only by the temperatures, but also by the kind of life which it contains.

The result of the expedition is the survey of a very considerable portion of the bottom of the Eastern Pacific, and the discovery of a number of interesting facts in regard to its shape. One of these is the proof that off the Mexican coast, especially off Acapulco and Manzanilla, there is a steep continental slope, at the base of which are a number of disconnected deep basins (2500 to 2900 fathoms). This is in marked contrast with the conditions which prevail on the east coast of Central America and the United States, where the continental shelf is wide.

Polar.

The Ziegler Relief Expedition.—The *Terra Nova*, the relief ship of the Ziegler Expedition (cf. this *Magazine*, p. 157) left Tromsoe on 14th June for Cape Flora, Franz Josef Land, with Mr. Champ on board. It is hoped that the *Terra Nova* will return in September with the members of the original expedition on board, but she is fitted out in such a way that, if necessary, she is capable of wintering in the Arctic.

Amundsen's Expedition to the Magnetic Pole.—According to a New York telegram, news arrived in San Francisco early in May that Captain Roald Amundsen's expedition had reached a point in the south of King William's Land, after having previously reached the magnetic pole. The telegram adds that Captain Amundsen seemed sure of completing the north-west passage. It will be recollected that King William's Land was the scene of the disaster to the Franklin Expedition. Previous to the telegram named above, the last news of Amundsen was dated August 1903, and is detailed in our March issue (p. 156).

General.

Geographical Scholarship at Oxford.—We have received the following intimation in regard to the Scholarship for 1905 :—

"An examination for one Scholarship of the value of £60 will be held on Thursday, October 12, 1905. Candidates, who must have taken Honours in one of the Final Schools of the University of Oxford, should send in their names to the Reader in Geography, Old Ashmolean Building, Broad Street, Oxford, not later than Monday, October 2. The Scholar elected will be required to attend the full course of instruction at the School of Geography during the academic year 1905-1906, and to enter for the University Diploma in Geography in June 1906. The range of the examination is indicated by the contents of the following books :—Dryer, *Lessons in Physical Geography*; George, *The Relations of Geography and History*; Mackinder, *Britain and the British Seas*. Questions will be set giving opportunities to students of Ancient or Modern History, or of Natural Science, who have devoted special attention to the Geographical aspects of their subjects."

At Cambridge, on 14th June, the honorary degree of Sc. D. was conferred on Commander R. F. Scott, in recognition of his work in connection with the British National Antarctic Expedition, and also on Colonel Sir Francis Younghusband, in recognition of his work in connection with the Tibet Mission.

Commercial Geography.

The Mineral Resources of Canada.—The Geological Survey of Canada has recently published a series of bulletins giving summary accounts of the minerals and mineral industries of the Dominion. In 1902 the output of coal in Canada was more than seven million tons. The principal areas where coal is at present worked are (1) the Nova Scotia coalfields, where the coal is of Carboniferous age, (2) the coalfields of Vancouver, where the beds are Cretaceous, as are also those of (3) the Crow's Nest Pass, British Colombia. Anthracite is mined in Alberta, and lignite in the Souris River district, Assiniboia, and in the Yukon district. The asbestos industry is of considerable importance, the product in 1902 being 40,000 tons. Canada now yields 88 per cent. of the world's supply of this mineral. The asbestos deposits are found in serpentine. Infusorial earth was produced in 1902 to the amount of 1000 tons. It is mined in Bass River lake and at St. Ann's, Nova Scotia, and is chiefly exported to the United States, where it is used for polishing and as a boiler covering.

At the present time Ontario is the only province producing salt, of which the output in 1902 was 64,000 tons.

NEW BOOKS.

ASIA.

Dai Nippon, the Britain of the East. A Study in National Evolution. By Henry Dyer, C.E., D.Sc., etc. Pp. xvi + 450. London: Blackie and Son, 1905.

Dai Nippon, the Japanese name for Great Japan, is the fitting title adopted by Professor Dyer for a book in which he tells the story of the evolution of modern Japan. There is little of the geographical element in it, and still less of the ethnographical. It deals almost entirely with the economic, industrial, and political aspect of things Japanese. It is a serious book dealing with weighty questions of national life. Dr. Dyer was the organiser and first Principal of the Kobu Daigakko or College of Engineering, which was the most important technical institution in Japan from its beginning in 1873 to its amalgamation in 1886 with the Tokyo University, to form what has since been the Imperial University of Japan. Dr. Dyer remained himself nine years in Japan, and can speak with authority on all questions connected with the engineering side of Japan's development. Very naturally he devotes a good deal of space to tracing the influence of the Engineering College on the industrial life of the people; while very little information is given to the casual reader concerning the important educative work of the various colleges of the Tokyo University, especially those of law, science, and medicine. The chapter on education is, however, very brief, and mainly statistical. A short chapter on national finance gives great credit to the Japanese statesmen, but fails to take into account one instructive feature of the process by which the depreciation of silver aided them in their manipulation of the paper currency. The Kinsatsu (=gold paper) was at par with the silver dollar in the seventies, and even (as it ought to have been) at a slight premium. It then depreciated rapidly; but in 1885 rose to par with the silver dollar again, which had meanwhile considerably depreciated. New "convertible" notes were issued practically based on silver coinage although remaining for internal purposes nominally gold. But silver continued depreciating; and at length, when in 1897 the Government brought the gold standard into real operation, "the one yen in gold, which is the new unit of coinage, was made approximately the same value as the old unit in silver, so as to avoid an abrupt change in the price of commodities and a disturbance of the relations between debtor and creditor." In fact the gold yen of to-day is only about half the value of the gold yen of thirty years ago, so that the Government have redeemed their original paper issue by specie payment equivalent to half its real original value. The process has been gradual, and has shown itself practically in a largely increased price of ordinary commodities. It is no doubt "a fine economical feat"! The chapter on industrial developments is an admirable piece of compilation; but probably the most interesting portions to the general reader will be those sections devoted to international relations and foreign politics. Like every one who has lived in the country and mixed with the leaders of the nation, Dr. Dyer has a supreme faith in the future of the Japanese, and it is with a very natural pride that he is able in an appendix to point to the early events of the present war as fully corroborating his forecast contained in the earlier chapters. His appreciation of the people is thoughtful and sympathetic, and yet absolutely free from those extravagances of sentiment which mar not a few of our writers on Japan. Dr. Dyer's book is not in any sense light reading. It is unique among books on the Far East in being ungarnished by any pictures. A simple serviceable map is its one illustration.

We commend its sensible, business-like pages to all who wish to gain a broad knowledge of how Japan has grown through the last thirty years.

Au Siam. Journal de voyage de M. et Mme. Emile Jottrand. Paris: Librairie Plon-Nourrit et Cie., 1905.

This volume contains the diary of a sojourn in Bangkok, the capital of Siam, for a period of a little over three years, beginning in October 1899. It is written for the most part by M. Jottrand, but here and there his wife contributes a chapter or a section, setting forth things Siamese from a lady's point of view. M. Jottrand is a Belgian by nationality, and in Bangkok he held the responsible position of assistant-judge, for which he was paid the miserable sum of 2880 francs, or £115, per annum. We gather from the diary that he had both civil and criminal jurisdiction; he was also employed in consular and international courts, and it would appear that as a criminal judge he had the power of inflicting capital punishment. As the climate of Bangkok is by no means healthy, we are bound to say that the remuneration of Europeans in the judicial department under the Siamese Government seems most inadequate, and in no way calculated to attract or secure a high class of official; we must add, however, that M. Jottrand makes no complaints about his salary. In the year 1900 he and his wife made an excursion to the famous ruins of Angkor in Cambodia, an excursion which, we are informed, is to be the subject of another volume now under preparation. For some three months in 1901 he was deputed as commissary of the Siamese Government to Korat, a town of Laos, noticeable only as the terminus of the railway. It was a dreary place, and Mme. Jottrand was the first white lady to reside in it. The diary, although now and then somewhat monotonous, is interesting and amusing. Much of it is taken up with elaborate descriptions of fêtes and shows, balls, banquets, funerals and such like, from which we need extract only a brief notice of a ball given by the Scotch residents of Bangkok on St. Andrew's Day:—"Les invités étaient reçus au seuil par le président de la Société, portant avec chic le joli costume des Highlanders. Tous les détails en étaient curieux et intéressants. Son court poignard scintillait de ces jolies pierres écossaises que nous avons toutes plus ou moins portées en broche. Une des topazes, très foncée, était grosse comme un œuf de pigeon, souliers à boucles d'argent, jambes nues, jupe plissée, le tartan retenu à l'épaule par une agrafe, le petit béret de velours, il était très agréable à voir. Les non-initiés regardaient avec intérêt les *quadrilles* écossais et les danses compliquées que rhythmaient des airs originaux. Certains cavaliers dansaient remarquablement bien, avec des claquements de pieds et des cris gutturaux pour marquer les figures."

To learn the Siamese language must be no easy task, for the alphabet contains no less than forty-four consonants, nineteen vowels, and thirty-three diphthongs; but besides this, it appears that the pronunciation of the consonants varies according to their position in the middle or at the end of words; simple vowels are often suppressed and so have to be guessed by the reader, while diphthongs sometimes count as much as five or six vowels, placed before, after, above and below a consonant. M. Jottrand has many amusing stories to tell of his experiences on the bench and in social life in Bangkok. As to its public life, Bangkok, according to M. Jottrand, is simply the scene of a permanent and exhilarating game of grab carried on by the European robbers. "Chaque branche de l'administration Siamoise est aux mains d'un certain groupe étranger qui généralement se considère comme un État dans l'État; la gendarmerie est danoise; la police et les finances sont anglaises; la justice est belge; la marine danoise; le

chemin de fer, allemand. La querelle du jour met en conflit ce dernier département et le ministère des finances. Celui-ci veut contrôler la gestion de celui-là, qui se rebiffe et déclare qu'il est un département indépendant. On se bat à coup de mémoires, sur un ton aigre-doux. Chaque légation protège les siens. C'est la question des fournitures de matériel qui agite les esprits en faisant naître les convoitises. La principale politique des Excellences consiste à regarder jalousement dans l'assiette du voisin et à veiller à ce qu'on ne fasse pas d'injustice. L'Italie même s'en mêle, car voici que le pays de l'oranger fabrique des locomotives et prétend même en exporter! De loin en loin, il est vrai les Allemands jettent un os à ronger aux affamés; quelques mille tonnes de rails ou une autre misère de ce genre; mais cela ne fait que les mettre en appétit, et chacun de déclamer contre le chauvoinisme allemand. Les Siamois, qui payent, s'en moquent pas mal; pour eux un *farang* (foreigner) est un farang—et un voleur est un voleur, ajoutent quelques-uns auxquels je laisse la responsabilité de cette traduction par trop libre!" M. Jottrand is by no means an admirer of England, and records with undisguised glee the depression among the English community at Bangkok during the earlier stages of the Boer War.

Rifle and Romance in the Indian Jungle. By Captain A. I. R. Glasfurd. London: John Lane, 1905.

There is, as Captain Glasfurd remarks in the preface to the present volume, no lack of books dealing with sport in India. Nearly every man (or woman!) who handles a Winchester repeater in the jungle thinks it necessary to record his adventures in cold print. Another work on the subject would be distinctly *de trop*—if written on the old familiar lines. But Captain Glasfurd's book is wholly delightful. He is not a mere slayer of animals: he is a naturalist, an artist, and a man of genuinely poetic feeling. The book contains enough and to spare of mere hunting adventures; the reader in search of such will assuredly not be disappointed, for the author's adventures are of uncommon variety and described with singular vividness of style.

But the really valuable portions of the book are those which record Captain Glasfurd's observations and impressions. A keen traveller and a good shot seldom go together with a good writer. But Captain Glasfurd is a singular exception: he writes well. There are passages and whole chapters of really exquisite prose, and the rare gift of finding the right word seems to come to him naturally. The impressions of the jungle with which the book opens, entitled "Morning," "Noon," and "Night," are very well done indeed, and convey to the reader with unusual power the peculiar spirit of the Indian wilds.

The photographs with which the book is profusely illustrated are generally clear and good, and the author's drawings always interesting, and occasionally of genuine artistic merit.

The Story of an Indian Upland. By F. B. Bradley-Birt, B.A., I.C.S. London: Smith, Elder and Co., 1905. *Price* 12*s.* 6*d.*

In the issue of this *Magazine* for October 1903 we had much pleasure in bringing to the notice of our readers Mr. Bradley-Birt's fascinating book on Chota Nagpoor. He has in the volume now before us done for the Sonthal Pergunnahs which lie to the north-east of Chota Nagpoor what he has done in the former volume for Chota Nagpoor, and the results are equally satisfactory and pleasing. It is true that in some parts of this volume he goes over some of the same ground as he did in his former work, but the reader has no cause to complain. The subject has lost none of its interest, and we are glad to meet the Sonthals

again in the tracts with which their name is specially connected. "Here," says Mr. Bradley-Birt, "Bengal, Behar, and Chota Nagpoor meet. Thrust in between them like a wedge is this debatable ground, a tangled mass of hill and jungle peopled by uncouth aboriginal races, standing like the farthest outpost of barbarism to face the highest civilisation that Hindu and Mussulman successively planted at its gates. Its primitiveness untouched by the stir of passing events, it has looked down with unresponsive gaze upon all that was best and highest and furthest advanced in the India of the day. It is the most interesting spot in all Bengal. Around the ruined cities that lie scattered at the foot of the hills gather memories of mighty empires long since passed away that rose and fell with typical Eastern suddenness, each bearing within itself from its foundation the seeds of incipient decay. But twenty miles, as the crow flies, from its borders stand the cities of Gaur and Pandua, magnificent even in decay and mindful of the pomp and glory that once was theirs; while but little further away lies Murshedabad, which, faring better at the hands of fate, still retains a living memory of its pride of place and power in the days of the Mussulman empire. Here were fought out the great issues between Hindu and Mussulman, Moghul and Pathan, emperor and rebellious viceroy—issues that transferred from one allegiance to another, as by a stroke of the pen, vast territories, careless under whom they fell, since the oppressor must needs be. Scene after scene as in a panorama passed in these cities of the plains, yet upon the rugged tract that frowned upon them from across the Ganges they made not even the most fleeting of impressions. There no change of vital importance ever came. In the first century of their existence this land and its original inhabitants could scarcely have been more primitive than they are to-day."

This remarkable tract of country is now inhabited by various races, the most important of which, *i.e.* the Sonthalis, have been already partly introduced to us in *Chota Nagpoor*, and in this volume their history, customs, etc., are dealt with in much greater detail. We must content ourselves, however, with noticing the Paharias, who justly claim the title of being the Highlanders of Bengal, "of Dravidian stock, the wildest and most backward of all the aboriginal tribes of Bengal. Whence they came and what events led to their coming no man knows. Buried in the long-forgotten past their early doings can only be surmised. In all probability they were in the advance guard of the great race movement that finally found its home in the neighbouring uplands, and urged onward by the stronger and more energetic tribes that followed in their rear they found themselves at last in the Rajmahal Hills—to them a veritable *cul-de-sac* shut in by the Ganges and the plains beyond, which were already peopled by a civilised and hostile race. Here they were at bay. Advance or retreat was impossible. But, fortunately for them, these hills provided all that they desired for their subsistence, and here they made their home. Nature seems to have adapted itself to all their needs. Drawing them into her mountain fastnesses, wellnigh inaccessible, and impregnable against attack, she furnished them with a safe retreat against their foes. They found the jungles on the slopes of the hills well stocked with game and herbs and fruits—all that their simple habits led them to demand of life. If need came they could sweep down upon the peaceful homesteads of the plains and carry off the harvests that a more industrious people had sown and reaped. The very position and luxuriance of the Rajmahal Hills encouraged them in idleness and depredations. There was little need for labour where nature supplied so much, while no better home for banditti could well have been designed than the rocky heights that overlooked the plains, yet defied the lowlander by their strength and inaccessibility. In the Rajmahal Hills the original stock of the Paharias has ever

since held possession, exclusive and jealous of all outside interference, clinging to their rocky homes with all the passionate devotion of a hill people. Successfully they have resisted every effort to dislodge them, forcing special terms even from the all-conquering British Raj, and to-day they still survive among their ancestral hills, tamed indeed to an unwonted law and order, but in possession still."

In connection with this tract of our Indian Empire, there are names the very mention of which recalls romance and history second to none in interest and glory in the illustrious annals of India, and to these Mr. Bradley-Birt has done ample justice, whether he deals with them in the exciting narrative of disaffection and rebellion, or in the more instructive story of statesmanlike and sympathetic administration. In our review of *Chota Nagpoor* we claimed for him that on his shoulders had fallen the mantle of Sir William Hunter, and we are very sure that the readers of this *Story of an Indian Upland* will readily recognise the justice of the claim. They will find the same wealth of diction, ornateness of style, enthusiasm for his subject, sympathy with the people, mastery of details and exuberance of language, which we found in *Orissa* and Sir W. Hunter's other works. The interest of the reader is maintained from the first page to the last, and the book is laid down with regret.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

Topographie Pratique de Reconnaissance et d'Exploration suivie de Notions Élémentaires Pratiques de Géodésie et d'Astronomie de Campagne. Avec 138 figures dans le texte. Pp. 340. *Prix* 7 *fr.* 50. Paris : Henri Charles-Lavauzelle, 1905.

Au Japon et en Extrême-Orient. Par Félicien Challaye. Pp. iv + 268. *Prix* 3 *fr.* 50. Paris : Librairie Armand Colin, 1905.

The Saint Lawrence Basin and its Borderlands, being the Story of their Discovery, Exploration, and Occupation. By Samuel Edward Dawson, Litt. D., F.R.S.C. Illustrated, and with Maps by J. G. Bartholomew. Demy 8vo. Pp. xl + 451. *Price* 7*s.* 6*d.* London : Lawrence and Bullen, 1905.

Problems of the Panama Canal, including Climatology of the Isthmus, Physics and Hydraulics of the River Chagres, Cut at the Continental Divide,' and Discussion of Plans for the Waterway. By Brig.-Gen. Henry L. Abbot. 8vo. *Price* 6*s.* Pp. 248. New York : The Macmillan Co., 1905.

Cities and Sights of Spain: A Handbook for Tourists. By Mrs. Aubrey le Blond. Cr. 8vo. Pp. xv + 214. *Price* 5*s.* London : George Bell and Sons, 1905.

From Tokyo to Tiflis: Uncensored Letters from the War. By Frederick Arthur M'Kenzie. Demy 8vo. Pp. x + 340. London : Hurst and Blackett, Ltd., 1905.

The Principal Navigations, Voyages, Traffiques, and Discoveries of the English Nation. By Richard Hakluyt. Vol. xii. Pp. xiv + 470. *Price* 10*s. net.* Glasgow : James MacLehose and Sons, 1905.

Our English Home. By C. W. Crook and W. H. Weston. Round the World Series, Geographical Handbooks. Pp. 64. *Price* 6*d.* Edinburgh : T. C. and E. C. Jack, 1905.

Also the following Reports, etc. :—

Report of the Seventy-Fourth Meeting of the British Association for the Advancement of Science, held at Cambridge in August 1904. Pp. cxxvii + 892. London: J. Murray, 1905.

Sinopsis Estadistica I Jeografica de la Republica de Chile en 1903. Primera Parte. Pp. xi + 355. Santiago, Chile, 1905.

Annual Report of the Yorkshire Philosophical Society for 1904. York, 1905.

Svenska Turistforeningens Årsskrift, 1905. Pp. viii + 489. Stockholm: The Swedish Touring Club, 1905.

The Burma Route Book. Part II. Routes in North-Eastern Burma. Compiled in the Intelligence Branch, Quartermaster-General's Department in India, 1903. Calcutta, 1905.

Neue Karten und Reliefs der Alpen, Studien über Geländedarstellung. Von Albrecht Penck. Pp. 112. Leipzig: Verlag von B. G. Teubner, 1904.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th April 1905:—One-inch Map (third edition, engraved in outline). —Sheets 1, 7, 8, 14, 30. Price 1s. 6d. each.

Six-inch Maps (Revised) Quarter Sheets, Heliozincographed, with Contours. Price 1s. each. *Banffshire.*—14 NE.; 30 NW.

1 : 2500 Scale Maps (Revised) with Houses ruled, and with Areas. Price 3s. each. *Banffshire.*—Sheets VII. 4, 8, 12, 14, 16; XIII. 11, 12, 14, 15; XIV. 9; XIX. 2, 3, 5, 9, 13; XXIV. 11, 12; XXV. 1, 5; XXVI. 10. *Elginshire.*—Sheets VIII. 15; IX. 5, 9, 11, 13, 14, 15; XIII. 2, 3, 4, 6, 7, 10, 11, 12, 14; XIV. 3, 6, 9, 10, 11, 12, 13, 14; XVIII. 13; XXII. 10, 14; XXIX. 12, 16; XXXII. 4, 11, 12, 15, 16. *Inverness-shire.*—Sheets X. 1; XI. 1, 2.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st May 1905:—One-inch Map (third edition). Printed in colours and folded in cover, or flat in sheets. Moffat, Sheet 16—Price, on paper, 1s. 6d.; mounted on linen, 2s. Engraved, in outline, Sheet 22—Price 1s. 6d. Engraved, with hills in brown or black, Sheets 1, 7, 8, 14, 15, 32, 33, 34—Price 1s. 6d. each.

Six-inch Maps (Revised) full Sheets, engraved, without contours. *Ross and Cromarty.*—Sheets 61, 82, 93—Price 2s. 6d. each. Sheet 102A—Price 2s.

Quarter Sheets, Heliozincographed, with Contours (Price 1s. each.) *Banffshire.*—11 SW.; 11 SE.; 12 NW.; 17 NW.; 17 SW.; 19 SE.; 20 NE.; 20 SW.; 20 SE.; 21 NW.; 21 SE.; 22 SW.; 24 SW.; 26 NW.; 26 SW.; 32 NW.; 32 SW. Without contours. *Banffshire.*—35 NE. *Elginshire.*—21 NW.; 21 NE.; 21 SW.; 24 SE.

1 : 2500 Scale Maps (Revised) with Houses ruled, and with Areas. Price 3s. each. *Banffshire.*—Sheets XIII. 6, 7, 8, 10; XIV. 1; XXIII. 16; XXIV. 4, 7, 8; XXV. 9. *Elginshire.*—Sheets IX. 10; XIII. 15; XIV. 5; XVIII. 2, 3, 5, 6, 7, 9, 10, 11, 14, 16; XXII. 11, 12, 15; XXIII. 1, 5; XXVI. 2, 6; XXX. 4, 5, 9, 13; XXXI. 1; XXXII. 8; XXXIII. 1, 2 (5 and 9), 6. Sheet XXXIII. 10. Price 1s. 6d. *Inverness-shire.*—Sheet X. 2, 3, 4.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

GEOLOGICAL SURVEY OF SCOTLAND.—The following publication was issued from 1st to 30th April 1905.—One-inch Map. Sheet 65. Price 6s.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

SOME RESULTS OF THE SCOTTISH NATIONAL ANTARCTIC EXPEDITION.

Owing to an oversight the author did not have the final proofs sent to him, consequently the following more essential *errata* must be noted. W. S. B.

Page 402. In first line of second paragraph, instead of *seventy-five soundings* read *seventy-five deep soundings.*

,, 405. In line 34 after *sounding* add *viz. in* 68° 32′ S. 12° 49′ W.

,, 407. In line 5 after *and* add *having sounded to the east, south, and west.*

,, 407. Footnote 5 should read : *Sud-Polar-Karte*, von V. von Haardt, 1895.

,, 408. In line 29 read *von Haardt* in place of *Von Haardt.*

,, 408. Footnote 7 should read : *Stanford, The Antarctic Regions*, undated, about 1901.

,, 409. In line 2 for *the position* read *this portion.*

,, 409. In line 18 insert *partially* before *inclined.*

,, 410. In line 9 after *Expedition* insert *as well as that of sedimentary rocks in South Georgia.*

,, 411. Insert in line 22 at end of paragraph, *Its western position strengthens the belief that it is continental.*

[1] Paper read at the British Association, Belfast, 16th September 1902.

2. BATHYMETRICAL SURVEY OF THE SOUTH ATLANTIC OCEAN AND WEDDELL SEA.

By William S. Bruce.

(*With Map and Illustrations.*)

Before the departure of the *Scotia* we had absolutely no knowledge of the depths, deposits, physical and biological conditions of the South Atlantic south of 39° S. through more than eighty degrees of longitude. It is true that there were bathymetrical maps in existence, but these were entirely hypothetical, and largely based on a single sounding taken by Ross in 68° 34′ S., 12° 49′ W., where he recorded 4000 fathoms no bottom,[1] a record which the Scottish Expedition has proved to be erroneous. The Swedish Expedition during its first cruise with Dr. Otto Nordenskjöld took some soundings in the vicinity of Graham's Land, including one of 1800 fathoms[2] in 63° S. 45° W., and during the second cruise with Dr. Gunnar Andersson took six soundings of great interest to the W. and NW. of South Georgia. Outside these few soundings the whole of our present bathymetrical knowledge of the south of the South Atlantic Ocean and Weddell Sea is derived from the soundings taken by the Scottish Expedition, and the same may be said for the other sections of the oceanographical work.

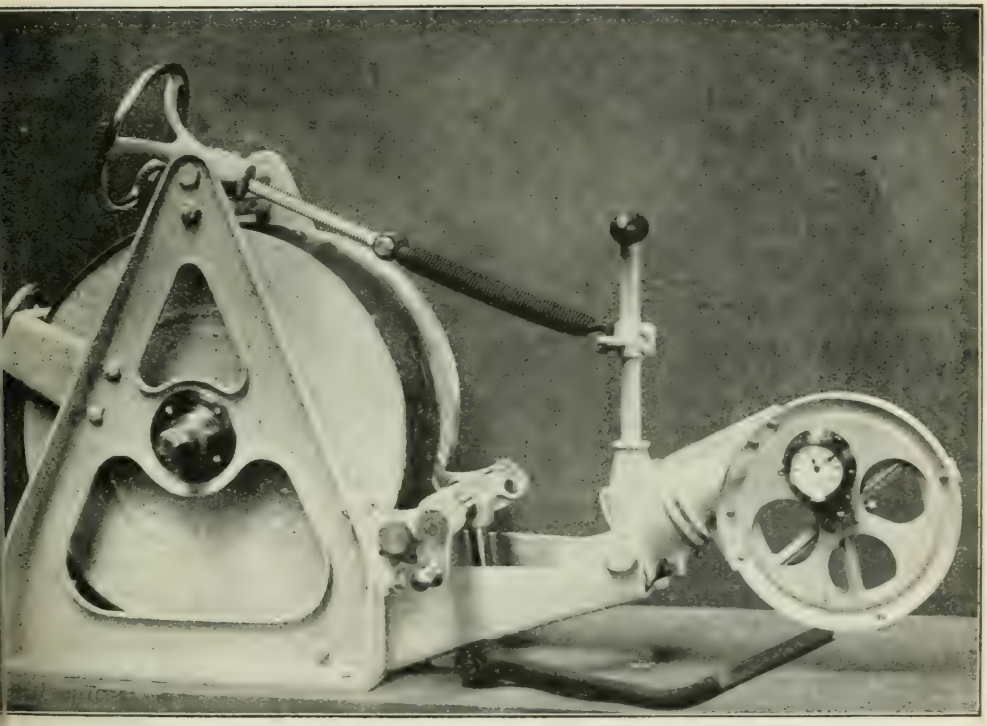
Altogether the *Scotia* took seventy-five soundings in the region described, besides nearly five hundred in the neighbourhood of the South Orkneys in water less than 100 fathoms. These last-named are not considered here. Twenty-six of these seventy-five soundings were taken south of the Antarctic Circle, and fifty were taken whilst navigating actually in the ice; forty-three were taken in water exceeding 2000 fathoms, twenty-three in water exceeding 2500—ten of the last being south of the Antarctic Circle. The deepest sounding was 2900 fathoms, or a depth of rather more than three and a quarter miles, in 39° 27′ S. 5° 17′ E., between Gough Island and Cape Town.

I conducted the sounding work myself, being assisted by Captain Thomas Robertson, Dr. Pirie, and the officers of the *Scotia*, and I may mention here that for most soundings taken I was able to secure samples and temperatures of sea-water at various depths from the surface to the bottom. Once the whole operation was over Mr. D. W. Wilton tested the specific gravities of the waters obtained, and Dr. Pirie secured and examined the samples of bottom deposits. The results of Dr. Pirie's examinations are given in the accompanying paper by him (see p. 413). The work was not carried out without considerable

[1] *Voyage of Discovery and Research in the Southern and Antarctic Regions during the years* 1839-43. By Captain Sir James Clark Ross, R.N., etc., 1847. Vol. II. chap. xiii. pp. 363, 364.

[2] I am indebted to my friend Dr. Otto Nordenskjöld for supplying me specially with the data of this eastermost sounding taken by the Swedish Expedition, which helps the drawing of the bathymetrical contours in this neighbourhood.

difficulty, labour, and discomfort, especially as we carried it on not only in a region of ice, but even in temperatures approaching zero Fahrenheit. Numbed fingers resulting from the water brought up with the wire and instruments which soaked and froze one's mittens, chilled bodies due to standing for long periods on the most exposed part of the weather side of the ship, made the work very different indeed from the usual run of hydrographic operations carried out in warmer and less boisterous parts of the world. Usually sounding platform, sounding



By permission of the Telegraph Construction and Maintenance Co., Ltd.

FIG. 1.—The Lucas Automatic Sounding-Machine.

This machine is for depths up to 6000 fathoms; it is fitted with a grooved wheel for driving by a rope band from a steam-winch or other engine, and with screw gear for guiding in the wire. The wire as it is paid out passes over a measuring wheel, the revolutions of which record on a dial the number of fathoms out; a spring brake, which is capable of stopping the reel instantly, is kept out of action by the tension of the wire during the run out, but when the sinker strikes the bottom the loss of tension allows the brake to spring back and stop the reel, and the depth can then be read off on the dial.

machine, and workers, were covered with ice from the frozen water carried aboard by the incoming wire. Pack ice floating in the water formed an additional difficulty, and there was often risk of it carrying away the sounding wire with valuable instruments attached to it. The

wire was often caught and entangled in the pack ice, and sometimes it would so seriously interfere with operations as to make it necessary to repeat the sounding a second, and even a third time.

I used the Lucas sounding-machine, which I had previously worked with in the Arctic regions in 1898 on board Major Coats's yacht *Blencathra* (Pandora), and had found thoroughly satisfactory. There were two of these on board, one carrying 6000 and the other 4000 fathoms of ordinary sounding wire. The latter was presented to the expedition by Major Coats. The type of wire which was most useful was a triple stranded wire specially made for the expedition. This wire was able to stand the wear and tear very much better than the single wire, and was safer for the instruments attached. Connected with the sounding-machine was a small quick-working steam-winch, with which we were easily able to wind the wire in at the rate of 100 fathoms per minute, the greatest speed attained being 144 fathoms per minute. The most satisfactory sounding-tube, and that most frequently used, was the Buchanan sounding-tube, invented by Mr. J. Y. Buchanan of the *Challenger* Expedition, a number of these, along with many other valuable oceanographical instruments, having been presented to me by H.S.H. the Prince of Monaco, who has taken such a deep interest in the work of the expedition.

The bathymetrical campaign commenced on 31st January 1903 by a sounding to the north of the South Orkneys of 1698 fathoms in 58° 22′ S. 45° 00′ W., a sample of diatom ooze being secured. On the following day we took another sounding, finding diatom ooze again at a depth of 2307 fathoms. Owing to the large quantity and the heavy nature of the ice, which was very closely packed, we had difficulty in finding a passage to the south in the neighbourhood of the South Orkneys, where we landed on the 4th of February, and found it necessary to sail 500 miles further east before we were able to push southward. This was not without bathymetrical interest, for by this means we were able to get three interesting soundings between the South Orkneys and South Sandwich Group in comparatively shallow water. To the south of the Sandwich Group to 70° 21′ S. 17° 00′ W., we took a series of soundings, the one furthest south being 2543 fathoms. Having been firmly beset a few miles south of this position owing to continued low temperatures, it was necessary to seek for a winter harbour, and for reasons already stated I selected the South Orkneys as being most suitable. The *Scotia* returned thither by a large sweep to the westward, taking 21 soundings, mostly in depths of about 2500 fathoms, except to the east of the South Orkneys, where the water shallowed. The track of the *Scotia* in fact follows, it will be found, as nearly as possible the 2500-fathom contour.

There was a lull in oceanographical work during the wintering of the *Scotia* for eight months when she was frozen up in Scotia Bay; during this time, however, local hydrographical survey work was carried on. Oceanographical work was again resumed, however, on November the 27th, ten soundings being taken between the South Orkneys and the Falkland Islands. After refitting at Buenos Aires and calling again at

Port Stanley, a course was steered so as to secure soundings between the South Shetlands and South Orkneys; but unfortunately a gale and heavy sea sprung up, which forced me to abandon this part of the programme of the second season's work. On account, however, of the much smaller quantity of ice, I was fortunate in being able to steer a south-easterly course from the South Orkneys over unexplored sea almost midway between the outward and homeward tracks of the previous season, getting a good series of soundings showing deeper water to the eastward than that indicated by the previous year's soundings, which were taken further to the south-west. It was also fortunate that for the same reason the expedition was able to penetrate 220 miles further south than the previous season, and thus determine the limits of the Weddell Sea to the south-east by the discovery of 150 miles of the coastline of the Antarctic Continent, which I have named Coats Land, after the two chief supporters of the Scottish Expedition, namely, Mr. James Coats, junr., of Paisley, and Major Andrew Coats, D.S.O., of Ayr.

In the vicinity of Coats Land the water shelves very markedly till depths of 161 and 159 fathoms were obtained two miles from the land. Off Coats Land the *Scotia* was beset in heavy ice and heaved out of the water four feet during a severe storm: temperatures below zero Fahrenheit ensuing, the good ship was not liberated for a week. Under such circumstances, once the *Scotia* was free, I was compelled to retreat; but there was yet important work to be done, and that was to determine whether or not Sir James Clark Ross's sounding of 4000 fathoms no bottom was correct: accordingly, a course was steered in that direction, and we got a good series of soundings towards it from the south-west, and although these increased in depth as we approached the locality of the Ross sounding, yet not getting more than 2620 fathoms within 90 miles of it made me doubt very much whether it really existed. Next day the *Scotia* had overrun the mark by more than 30 miles to the east, where a sounding of 2487 fathoms was taken, which very greatly reduced the chance of Ross's sounding being correct. Next day, viz. March 23, 1904, we were within two miles of the assigned position of Ross's sounding, and I was fully prepared with wire and other gear for sounding in water up to 6000 fathoms, should any such depth occur. The occasion was an important one, and every one on board was eager to see the result of this interesting sounding. To illustrate how the sounding was taken, I went out in the dinghey and took photographs of the ship lying in position ready for sounding, and also of the sounding-gear. These photographs now appear for the first time; and it is interesting to compare our gear with that which Ross used sixty-one years previously. Instead of working with a compact machine from the ship itself, and having the valuable assistance of steam, and instead of working with apparatus that has taken sixty years to bring to its present state of perfection, this old veteran and pioneer of deep-sea exploration did wonderful work with very rude apparatus, and gave us much information about ocean depths in many parts of the world. Ross did all his sounding from boats lowered for the purpose, with hemp line instead of wire, which was laboriously hauled in by hand on large cumbersome drums by his crew, an example

of patience and endurance which deserves all praise, and which in these days we would do well to follow. Ross's line evidently sagged after the

FIG. 2.—*Scotia* sounding in supposed Ross Deep on March 23, 1904.

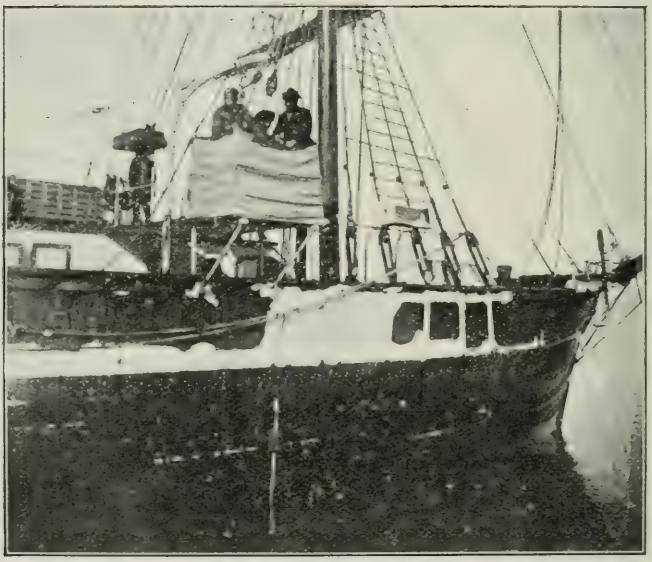


FIG. 3.—*Scotia* sounding in supposed Ross Deep 68° 32′ S. 12° 49′ W., on March 23, 1904.

weights had touched bottom, being carried by the strong currents existing in this neighbourhood, which prevented our trawl from reaching

bottom on three occasions in spite of extra weight being attached and a large amount of extra cable being paid out. Here with every modern appliance the *Scotia* touched bottom with 2660 fathoms of wire, bringing up with the Buchanan sounder a large sample of "blue mud."

Next day to the northward we obtained water of a similar depth, and eliminated the possibility of there being any depth equivalent to Ross's in this region. Thus, after more than sixty years of doubt, Ross's Deep was removed from the map, and all the bathymetrical maps based upon this sounding were no longer of any practical use.

We were still navigating in the region of ice, and the weather was getting very boisterous, and the nights were long and dark, and a sharp outlook had to be continually kept to avoid collisions with icebergs, which were especially numerous and of great size. But more work had to be done, and that in what is probably the stormiest part of the world in one of the stormiest seasons of the year. Our destination was Cape Town, but by steering the straightest and easiest course I should have found myself traversing ocean which the *Valdivia* had previously sounded in 1898-99. My object was therefore to keep as far to the westward as possible, making Gough Island our objective. This we succeeded in doing, though not without difficulty on account of a long succession of north-westerly gales and very heavy seas. I was determined, however, to get soundings in this part of the world, where none had previously been taken, even if it meant the sacrifice of all the gear on board; for once at Cape Town, the work for which the expedition specially set out would be finished. The sacrifice had to be made, for probably soundings were never made under such boisterous conditions before, and we arrived at Cape Town with very little in the way of sounding-gear on board. The result, however, was a fine line of fifteen important soundings from 68° S. to 40° S. along the meridian 10° W., completely altering previous conceptions of the form of this part of the bottom of the ocean. A further series of five soundings in depths up to 2900 fathoms was taken along the latitude of 40° S. 120 miles south of previous soundings, between Gough Island and the Cape; local soundings were also made in the vicinity of Gough Island.

The accompanying map illustrates the result of the *Scotia's* bathymetrical work, and it is interesting to compare it with previous maps which were chiefly theoretical, and based to a large extent on Ross's sounding.[1] In this map I have made use of the few soundings taken by

[1] 1. *Région Polaire Antarctique, Atlas Universel.* Par Vivien Saint Martin. Hachette et Cie., 1883.

2. *South Polar Chart showing Heights of Land and Depths of Sea on Lambert's Equal Area Projection.* By John George Bartholomew. *Scottish Geographical Magazine*, vol. ii., 1886, p. 576.

3. *South Polar Regions*, by J. G. Bartholomew, F.R.S.E., showing height of land and depth of sea. Map accompanying "The Renewal of Antarctic Exploration," by John Murray, Ph.D., LL.D., of the *Challenger* Expedition. *The Geographical Journal*, vol. iii., p. 80.

4. H. O. Forbes, *The Chatham Islands: their relation to a former Southern Continent.* With map. 1893. R.G.S. supplementary papers, iii. 607-637.

5. Von Haardt, *Sud-Polar-Karte von von Haardt*, 1895.

the Swedish Expedition to the westward, and of those of the *Valdivia* to the east of Bouvet Island. Before the departure of the *Scotia* the newly taken soundings by Dr. J. Gunnar Andersson of 3279 fathoms in 48° 27′ S. 42° 36′ W., seemed to bear out the hypothesis of Sir John Murray and Mr. J. G. Bartholomew that there was deep water connecting this western part of the South Atlantic Ocean with Ross's sounding of 4000 fathoms no bottom, and that this deep water was continued far to the east beyond longitude 36° E. in high southern latitudes where the *Valdivia* obtained three soundings of more than 3000 fathoms.

The first season's work of the *Scotia*, although it added much to our knowledge of the bathymetrical conditions prevailing in the Weddell Sea, did not refute any of these previous ideas of the depth of the sea in the region mapped out by Murray and Bartholomew. It was interesting, however,to have mapped out the area of the Weddell Sea in which there is a depth of about 2500 fathoms, extending as far as 42° W. in lat. 65° S. to 70° 21′ S. in 17° W., and to have demonstrated that the water deepened as one went further east. The *Scotia* soundings also showed a shallowing of water towards the Sandwich Group from the south, and demonstrated quite shallow water by six soundings taken between the Sandwich Group and the South Orkneys, water which appears to be certainly less than 1500 fathoms. The second voyage of the *Scotia* demonstrated clearly the deepening of the water to the eastward of the 2500-fathom contour. Our first sounding taken in higher southern latitudes than we had reached the previous year showed a shallowing of the water to the south up to 1131 fathoms, on March 3rd, eleven miles from Coats Land, which we discovered that morning in 72° 25′ S. 17° 27′ W. The discovery of Coats Land in this position was most important, and falls in approximately with the position of the coastline of Antarctica according to Von Haardt, who apparently did not take Ross's sounding into account. The belief in Ross's sounding necessarily compelled Murray and Bartholomew to throw back their continental line in this region south of 80° S., and personally I must say that I was inclined to this view before the departure of the *Scotia*.

The *Scotia* coasted along this portion of the Antarctic continent, so suitably named Antarctica, for a distance of 150 miles, and in two places—30 miles apart—obtained water of 159 and 161 fathoms two miles from the shore. This last-named sounding was obtained in the highest southern latitude attained by the *Scotia*, viz. 74° 1′ S. On her return towards the north-east along a stretch of 180 miles the *Scotia* obtained soundings in less than 2000 fathoms on three different occasions 30 to 50 miles from the coast, two of the soundings being less than 1500 fathoms. In

6. *South Polar Chart*, by J. G. Bartholomew, F.R.S.E., showing Sir John Murray's proposed scheme for Antarctic Exploration, 1898.
7. Stanford, *South Polar Regions*. Undated, about 1901.
8. *Meerestiefen im Atlantischen u. Indischen Ocean*, etc., by Dr. Gerhard Schott. *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia,"* 1898-99. Band i. Atlas. Jena, 1902.
9. *Süd-Polar Karte*. Entworfen von A. Petermann-Stieler's Hand Atlas, plate 6. Gotha: Justus Perthes, 1905.

this vicinity, viz. 71° 30′ S. 12° 30′ W., Ross in 1843 narrowly escaped discovering the position of the Antarctic coastline discovered by us. From this point northwards the water deepened, attaining a depth of 2764 fathoms, our deepest Antarctic sounding, in 61° 21′ S. 13° 02′ W.: in the locality of Ross's sounding already described the *Scotia* touched bottom in 2660 fathoms. After the deepest sounding the water shallowed up, until in 57° S. 10° W. we crossed the 2500-fathom contour. One hundred miles farther north we obtained 2270 fathoms, and crossing the 2000-fathom contour, touched bottom in 1766 fathoms in 52° 33′ S. 9° 47′ W. We held this shallow water right up to Gough Island for 750 miles along the 10th meridian, getting hard ground almost all the way. This was a discovery of the greatest importance, as it showed a continuation of the South Atlantic rise a thousand miles further south than it was previously known to exist. There is little doubt in my mind that this comparatively shallow water extends to the Sandwich Group and to the shallow rise on which Bouvet Island is situated. More soundings, however, are highly desirable to the east and west of the line of soundings taken by the *Scotia* along the 10th meridian. Dr. Pirie is inclined to the opinion that the water to the east of the Sandwich Group may be 500 fathoms deeper than I have indicated; but although I think the water must deepen very rapidly on the eastern side of the Sandwich Group, yet I do not think water of over 2000 fathoms will be found there. One thing is certain, and that is that the "deep" discovered by the *Valdivia* is independent of that discovered by the *Antarctic*, the water shallowing 1000 to 1500 fathoms between them. I believe that the "deep" discovered by the *Valdivia* extends almost as far as 20° W. in 65° S., according to three soundings taken by the *Scotia* in this region in depths exceeding 2700 fathoms. Future investigation will alone show whether the *Antarctic* deep, which is founded on one sounding only, is really as extensive as I have made it. In this connection it is interesting to note that the "deeps" existing in the South Atlantic Ocean are one and all isolated and not very extensive in area. One of Sir John Murray's reasons for believing in the existence of Ross's supposed 4000 fathoms and its connection with the deep to the north of South Georgia, was the temperature of the deep water to the east of South America,[1] but this will now have to be accounted for in some other way: possibly the series of salinities and temperatures of the sea taken by the *Scotia* may throw some light on this question.

Some time ago Mr. H. O. Forbes, in a paper[2] on the Chatham Islands and their relation to a former Southern Continent, showed a relationship not only between these islands, New Zealand and Eastern Australia and Antarctica, but also a connection between Madagascar and South America and Antarctica. It is not without importance and interest that the *Scotia* soundings have helped to prove Forbes's theory.

[1] "The Renewal of Antarctic Exploration," by John Murray, Ph.D., LL.D., of the *Challenger* Expedition. *The Geographical Journal*, vol. iii., 1894, p. 12.

[2] *The Chatham Islands: their Relation to a former Southern Continent.* By Henry O. Forbes. R.G.S. supplementary papers, III., part iv., 1893.

by showing the existence of a long ridge about 300 miles in breadth, extending in a curve from Madagascar to Bouvet Island, and from Bouvet Island to the Sandwich Group, whence there is a forked connection through the South Orkneys to Graham's Land, and through South Georgia to the Falkland Islands and South American Continent. Thus Antarctica, South America and Madagascar become connected with one another in a most direct manner by this "rise." The discovery of sedimentary rocks in the South Orkneys by Dr. Pirie,[1] of the Scottish Expedition, proves the existence of a much greater extension of land to the south-east of South America in former times, than was previously expected. It is interesting also to notice that the mid-Atlantic "rise" becomes connected

FIG. 4.—Alternating shales and greywackés in Wilton Bay, South Orkneys.

with the "rise" between Bouvet Island and the Sandwich Group, and this may be of interest in relation to the distribution of the fossil faunas of South America and Africa. It will be seen by the accompanying map that I have given a much larger area for the continent Antarctica, and have made it appear more extensive and continuous than in any recent maps, especially in the region of Graham's Land and the Weddell Sea. This is directly opposed to Sir Clements Markham's recent theory,[2] (which to my mind is open to severe criticism), that the Antarctic area

---

[1] "On the Graptolite-bearing Rocks of the South Orkneys." By J. H. Harvey Pirie. *Proc. Roy. Soc. Edin.*, xxv., 1905.

[2] Address to the Royal Geographical Society, 1905. By Sir Clements R. Markham, K.C.B., F.R.S., President. *Geographical Journal*, vol. xxvi., 1905, pp. 1-28.

consists of two land masses of unequal size, Victoria Land and Edward VII. Land, separated by a great barrier of ice, and of two seas extending far to the south, the Ross Sea and the Weddell Sea. As regards the Weddell Sea, Sir Clements Markham inclines to the belief that Graham's Land is a large island, and that the land discovered by the Scottish National Antarctic Expedition is an island and not part of the Antarctic Continent. Some criticism will doubtless be offered to the hypothetical coastline of Antarctica that I have inserted between Coats Land and Enderby Land, but I see no other way of accounting for the obstructions which all navigators have met with who have attempted to penetrate south in this region. Cook, Bellinghausen, Biscoe, Ross and Moore, between the years 1778 and 1845, have all been prevented from penetrating far south along the whole of this line. In 40° E. the *Valdivia* found the sea shallowing to the south; in 10° W. the *Scotia* again found the sea shallowing to the south; in 25° W. the *Scotia* again found the sea shallowing towards the south, and for fully 150 miles followed the coastline of Coats Land running in a south-westerly direction in accordance with this shallowing. In all the *Scotia* soundings in the Weddell Sea, south of 65° S. and between the longitudes of 10° and 45° W., those taken to the south and west are shallower than those to the north and east. All the evidence gathered together tends to prove that Coats Land is out-and-out continental and not insular.

Weddell, I believe, like Ross, was not far from discovering the edge of the Antarctic Continent when he turned homeward, and one strong reason I have for believing this is the large number of birds that Weddell met in 74° 15′ S., which entirely accords with the distribution of birds in relation to our discovery of Coats Land. Just before our arrival off this coast bird-life was very plentiful, though previously scarce. The land reported by Morrell in 1823 has, up till now, not been considered sufficiently reliable to be placed on most Antarctic Charts. It appears, however, on this chart; and one of the reasons is that Ross in 1843 supports Morrell by describing the appearance of land to the south of him when in 65° S. 44° W., though it is doubtful whether Morrell's Land, lying between this and the South Orkneys, exists, unless it is a small island which has escaped the vigilance of recent navigators. It appears to me also that the evidence in favour of Graham's Land being part of the Antarctic Continent is greater than that in favour of its insularity. There is not much doubt that the shallow water of about 260 fathoms discovered by the *Belgica* in 1898 is strong evidence in favour of the continent being continued from Graham's Land through Alexander Land to the south-west at least as far as 100° W. in about 73° or 74° S., and that if Morrell's Land be correct in 71° S., that it is continuous with Alexander I. Land, Graham's Land, and Coats Land—that is "Antarctica." Sir Clements Markham has spoken of warm and snow-laden winds experienced at the winter quarters of the *Discovery* as blowing across the Pole from the Weddell Sea. This is entirely at variance with the observations taken on board the *Scotia* and at Scotia Bay, South Orkneys. If such high temperatures exist in the Weddell Sea, how does Markham account for such low temperatures at the South Orkneys, where it was possible in

1903 for a ship to be frozen in for eight months, and in 1904 for a much longer period? According to Mr. Mossman's observations, who was in charge of the Omond House Station for the Argentine Government, a ship would have been frozen in for fully twelve months during 1904-5.

Is it not remarkable that temperatures of -40° F. should have been recorded in the South Orkneys at the northern extremity of the Weddell Sea, if at the same time warm winds were to travel from that same sea across the Pole to Victoria Land? One of the strongest pieces of evidence that exists supporting the presence of a large mass of land existing to the south and west of the South Orkneys is the extremely low

FIG. 5.—*Scotia* beset in heavy ice in 74° 1′ S. off Coats Land. The shearlegs show the position of the baited trap in 161 fathoms.

temperatures which are recorded with winds from that direction. During 1903 the Weddell Sea was very full of ice, and in the middle of February the *Scotia* was beset and frozen in 70° 25′ S. 17° W. Low temperatures were experienced by the *Scotia* in the middle of March when in the vicinity of Morrell and Ross's Land. In 1904 the *Scotia* was beset and frozen in for a week with temperatures below zero, and with great dryness of the atmosphere off Coats Land—strong evidence surely of cold extensive continental masses. Altogether, it seems evidence increases rather than decreases in favour of the continuity and continentality of Antarctic land masses. Professor von Drygalski, by the discovery of Kaiser Wilhelm II. Land, has added to the land mass of the Antarctic regions; Captain Scott has added King Edward VII. Land; while the Scottish Expedition has added Coats Land.

3. DEEP-SEA DEPOSITS OF THE SOUTH ATLANTIC OCEAN AND WEDDELL SEA.

By J. H. Harvey Pirie, B.Sc., M.B.

(With Map.)

The deep-sea deposits of the area traversed by the *Scotia* include three main types, viz. Globigerina Ooze, Diatom Ooze, and Blue Muds of Terrigenous origin.

Globigerina Ooze.—The Globigerina Ooze area of the South Atlantic was crossed in two localities: (1) On the passage between the South Orkneys and the Falkland Islands. Here it forms a narrow band between the South American terrigenous deposits and the Diatom Ooze band. One sample only was obtained from a depth of 1946 fathoms: it contains 10 per cent. $CaCO_3$, and the commonest forms of Foraminifera are *Globigerina dutertrei*, *G. inflata*, and *G. bulloides* (dwarfed); less common *G. pachyderma*, *Pulvinulina canariensis*, *P. crassa*, and *P. elegans*; rare forms *Spiroloculina tenuis*, *P. micheliniana*, *Truncatulina pygmæa* and *T. hutemplei*; also numerous arenaceous forms. The mineral particles of this deposit are largely of volcanic origin. (2) To the south and east of Gough Island. The southern edge of the Globigerina Ooze is here about 48° S. lat. A sample from 48° 6′ S. 10° 6′ W. from a depth of 1742 fathoms might be classed either as a Globigerina Ooze or as a Diatom Ooze, containing as it does 55 per cent. $CaCO_3$ and 30 per cent. siliceous organisms. The trawl at this station brought up numerous pebbles, some of them showing fine glacial striæ; these pebbles include pieces of quartzite, greywacké, slate, granite, diorite, and basalt. In 41° 30′ S. 9° 55′ W. the $CaCO_3$ rises to 71 per cent., and Coccoliths and Rhabdoliths are met with in addition to Foraminifera. To the east of Gough Island in 40° 8′ S. 1° 50′ E. and 39° 48′ S. 2° 22′ E. the $CaCO_3$ falls to 46 per cent. and 40 per cent. respectively, while the "fine washings" (clayey matter and minute mineral particles under 0·5 mm. in diameter) rise to 50 per cent. and 56 per cent. The depth here is 2645 fathoms. This shows an approach to the Red Clay, an area of which lies to the SW. of the Cape of Good Hope.

Diatom Ooze.—The circumpolar Diatom Ooze band was likewise crossed in two regions: (1) Between the Falkland Islands and the South Orkneys. The band is here very narrow. Owing to heavy weather sounding was carried out with great difficulty, and only one really good sample was obtained, from a depth of 2180 fathoms in 59° 23′ S. 49° 8′ W. This contains about 15 per cent. siliceous organisms, including Diatom species of *Navicula*, *Coscinodiscus*, *Fragillaria*, *Hemiaulus*, *Actinocyclus*, *Rhizosolenia*, etc.; Radiolaria are also fairly abundant. As in the Globigerina Ooze further north, volcanic mineral particles are numerous, and the samples might indeed be classed as volcanic Muds or Oozes. These particles may be the product of submarine volcanic activity, but are quite possibly derived from the active volcanoes or volcanic rocks of West Antarctica or the South Shetlands. (2) Along the meridian of 10° W.

long. The band is here much wider, extending from about 48° S. to about 59° S. The transition from the Blue Mud on the southern edge is probably pretty sharp—in the Blue Mud from 61° 21′ S. 13° 2′ W. there are no Diatoms, in the Ooze from 56° 58′ S. 10° 3′ W. they form 55 per cent. of the whole deposit, in 51° 7′ S. 9° 31′ W., 2103 fathoms, the percentage rises to 70. The former sample contains 40 per cent. of mineral particles, mostly volcanic, including volcanic glass, pumice, palagonite, augite, magnetite, felspar, and a little quartz, biotite, and hornblende. As this sounding lies directly to the east of the South Sandwich group, which, so far as is known, is entirely volcanic, the probability is that these particles have been carried thence by the prevalent westerly winds or by floating ice.

The relative amounts of Diatoms in the surface waters and in the deposits form a marked contrast. Over the whole of the Blue Mud area of the Weddell Sea Diatoms are extremely abundant in the surface waters; in the deposits, on the other hand, they are either entirely absent or present only in very small quantity. Their maximum occurrence on the bottom is in about 51° or 52° S., where, in the surface waters, they are comparatively infrequent. Can this absence in the Blue Mud be accounted for by the rapid accumulation of the glacial detritus hiding them? I think not—for a reason that is given in the paragraph dealing with the Blue Mud resembling Red Clay. It is not a question of depth, for the difference is inconsiderable—about 2400-2700 fathoms for the Blue Mud, and 2100-2500 fathoms for the Diatom Ooze; nor can it be accounted for by the surface currents —in the southern part of the Weddell Sea these are westerly, and in the northern part about the boundary of the Blue Muds and Diatom Ooze, easterly. One is thrown back on the explanation tentatively put forward by Dr. Phillipi, who found the same condition on the German Antarctic Expedition,[1]* viz., a northerly undercurrent which carries off the Diatoms northward. Some indication of a strong undercurrent was got on the *Scotia* while trawling[2]; although this was south of 70° S. lat., it may be a widespread condition, and possibly the study of the temperatures and salinities at different depths will throw further light on this question.

Blue Mud.—The northern boundary is, in the area under consideration, a little to the north of the parallel of 60° S., and the deposit extends from there southwards to Antarctica. Within this area most of the material carried off Antarctic lands is deposited through the gradual dissolution of the icebergs. I say most of the material, because some is met with in the Diatom Ooze, and in the Globigerina Ooze at least as far north as the parallel of 40°, but in much less amount.

A typical specimen from the sounding-tube has the following characteristics. It is of a greenish-grey or bluish-grey colour, and is a coherent, moderately tough mud with a sufficiently clayey character to give it an unctuous feeling, but when rubbed between the finger-tips one can always feel some gritty particles. When dried it is of a light grey

* The figures refer to the references at the end of the paper.

colour and has a slightly clayey odour when breathed upon, and is capable of taking a lustrous polish when rubbed on the finger-nail. There is never any smell of sulphuretted hydrogen as in many terrigenous muds. Of $CaCO_3$ there is in most cases none, but every now and again a certain amount occurs, varying from a mere trace up to 6 per cent. This is from the shells of Foraminifera, principally *G. dutertrei*, more rarely also *Truncatulina wuellerstorfi*, *T. pygmæa*, *G. bulloides*, *G. dubia*, *G. pachyderma* and *Pullenia sphæroides*. This patchy occurrence of calcareous Foraminifera was also noted on the German Expedition[3]; and a somewhat similar condition on the *Valdivia* Expedition, where a patch of Globigerina Ooze was found between lime-free Blue Mud and Diatom Ooze areas.[4] The localities from which lime-containing samples were obtained are distinguished on the chart from those where the deposits contained no calcareous matter.

Siliceous organisms as before mentioned are extremely rare; they may be entirely absent or there may be from a trace up to 1 per cent. or 2 per cent., and these are chiefly sponge spicules and fragments of Radiolaria, very rarely Diatoms.

Mineral particles over 0·05 mm. in diameter form 10 per cent. to 20 per cent. of the deposit; the majority are angular in shape, but the larger fragments up to 2 or 3 mm. in diameter are generally sub-angular, and occasionally glacial striæ may be detected on them. Quartz grains predominate largely, but a great variety of other minerals occurs. Glauconite is rare, being only found as casts in a few of the samples in which there are calcareous Foraminifera. Manganese is common as a thin pellicle over other mineral particles, and a few very small grains occur, but there are no nodules such as are found in the abyssal Red Clays.

The remainder of the deposit is made up of "fine washings." When examined microscopically this part is found to contain occasional fragments of siliceous organisms and a small amount of true amorphous clayey matter, but it largely consists of minute mineral fragments under 0·05 mm. in size, the majority being probably between 0·02 and 0·005 mm. These represent the "rock flour" produced by the abrasive action of the Antarctic ice-sheets; this is carried out to sea partly in the ice of the icebergs, but, no doubt, largely also suspended in the water.

Additional information with regard to the deposits is given by the trawl. This usually brought up a large quantity of mud and rocks. The latter vary in size from fine gravel up to boulders weighing over two cwts. Most are typical sub-angular boulders such as occur in boulder clays, and they frequently show striations. Some of the rock specimens have part of their surface clear, and part coated with manganese; the shape indicates that the latter part must have been embedded in the mud, while the former projected out into the water. A great variety of rocks are present, plutonic igneous rocks being perhaps the most common—gabbro, diorite, quartz-porphyry and, especially, granites: of volcanic rocks, basalts are the most numerous; there occur also andesites and trachytes, pumice, scoriæ, and indurated tuff. Of sedimentary rocks, sandstones, limestones, shales, slate, grey-

wacke, quartzite, and a clay ironstone nodule were brought up. The following metamorphic rocks occurred: Hornblende gneiss, chlorite schist, mica schist, cleaved phyllitic slate, and garnetiferous quartzite.

The presence of these plutonic, sedimentary, and metamorphic rocks, as pointed out by Sir John Murray,[5] clearly indicates the continental character of the Antarctic land, although it is impossible, unfortunately, to locate the origin of these various boulders. Large numbers of arenaceous Foraminifera were also obtained from the mud in the trawl, belonging to many different genera. It is noteworthy that only one whale's ear-bone was brought up. As whales are probably quite as numerous, if not more so, in this area than in the Red Clay area of the Pacific, the explanation can only be that they are buried by the rapidity with which this deposit is accumulating as contrasted with the extreme slowness of the Red Clays.

For comparison, a sample of clay from the Portobello brick-field was similarly examined. In most of its physical characters, and in the proportion of mineral particles, and nature of the "fine washings," it was found to be practically indistinguishable from a typical Weddell Sea Blue Mud. This clay is one which has been laid down during the Ice Age as a glacial deposit in shallow water.

Blue Mud approximating to Red Clay.—The area of Blue Mud shaded on the map approaches Red Clay in many of its characters. The colour is more of a brownish grey than the blue or green grey of the typical Blue Mud: it is more tenacious and clayey, and it is not so easily rubbed down for microscopic examination, but still much more easily than a typical Pacific or Atlantic Red Clay. The mineral particles average only about three per cent., of which a considerable number are of volcanic origin, but too much reliance cannot be put on this for classification, as volcanic minerals are quite common in the Blue Muds. Ninety-five to ninety-eight per cent. of the deposit consists of "fine washings," but it is the character of these that differentiates the deposit from the true Red Clays. There is certainly a considerably larger proportion of true clay than in the typical Blue Muds, but there is still a large amount of very minute land-derived mineral particles—the finest rock-flour—which has probably reached its destination largely in suspension. This area is, on the whole, about 200 fathoms deeper than the surrounding seas, but the difference in the character of the bottom is probably mainly accounted for by the comparative infrequency of bergs within this area owing to the set of the currents. Here the rate of accumulation must be slower than in the main Blue Mud area, but as not a single Diatom was noted in any of the samples, one is precluded from accepting the hypothesis that these get lost amidst the glacial detritus.

Beyond the area from which samples were obtained by the *Scotia* the boundaries of the deposits as shown on the accompanying chart are mainly as given by Sir John Murray in the *Challenger* reports,[6] and within that area the chief change made on his map is a shifting northwards of the Diatom Ooze band, and the differentiation of the area of Blue Mud which resembles a Red Clay in some respects.

As no detailed account of the deposits obtained by the *Valdivia* from the area to the N. and E. of Bouvet Island has yet been published, I have drawn the probable boundaries of the different deposits in that region from the information given in Dr. Schott's Atlas[7] as to the nature of the bottom samples.

I have to express my great indebtedness to Sir John Murray for instruction at the *Challenger* office in the general methods of examining deep-sea deposits, which methods have been used in the investigation of the *Scotia* samples; also to Professor James Geikie, in whose laboratory the present work was carried on; and to Mr. F. G. Pearcey for the identification of the Foraminifera.

References.

[1] Phillipi. *Veroffentlichungen des Instituts für Meereskunde und des Geographischen Instituts an der Universität Berlin.* Heft. Oct. 5. 1903, pp. 137-140.

[2] Cf. this *Magazine*, January 1905, p. 5.

[3] Phillipi. *loc. cit.*

[4] Murray and Phillipi. *Centralblatt für Mineralogie*, 1901, No. 17.

[5] Murray and Renard. *Challenger Reports*, Deep Sea Deposits, p. 164.

[6] Murray and Renard. *Challenger Reports*, Deep Sea Deposits, Chart 1.

[7] Schott. *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition.* Band 1, Tafel iii.

4. METEOROLOGY.

By Robert C. Mossman, F.R.S.E.

(With Illustrations.)

In the report of the first Antarctic voyage of the *Scotia*[1] a somewhat detailed account was given of the meteorological work down to the end of October 1903. The data further available for discussion are as follows:—(1) The observations made at Laurie Island, South Orkneys, from November 1, 1903, to December 31, 1904. (2) The observations made on the *Scotia* while at sea on her voyage to and from Buenos Aires, and also from the South Orkneys to Coats Land, and thence to Cape Town *via* Gough Island. (3) The observations made between Cape Town and home. (4) Complete data from a base station at Cape Pembroke, Falkland Islands, consisting of eye observations every four hours for the two years 1903 and 1904, supplemented by barograph and sunshine records. As regards the above data the discussion will be confined in the present instance almost wholly to the observations made at Laurie Island, South Orkneys. The other observations are at present being reduced, but fully a year will elapse before the examination is

[1] See this *Magazine*, vol. xx. pp. 113-120.

completed. It will be remembered that the meteorological and magnetical station at Scotia Bay was handed over to the Argentine Meteorological Office on February 22, 1904, and the writer remained in charge until relieved by the *Uruguay* on January 1 of the present year. I am indebted to Mr. Walter G. Davis, director of the Argentine Meteorological Office, for permission to utilise the data taken subsequent to the departure of the *Scotia* on February 22, 1904. Attention may also be called to the circumstance that small differences may be found between the meteorological values given in this notice and those in process of publication by the Argentine Meteorological Office, after being checked by the computing staffs at Buenos Aires and Cordoba. It is not expected that

FIG. 6.—Lighthouse at Cape Pembroke, Falkland Islands. Sub-Antarctic Meteorological Station in connection with Scottish National Antarctic Expedition.

any large or important errors will be disclosed by this second examination of the South Orkney observations, but it is necessary to draw attention to the possibility of small mistakes having been made in the preliminary computations, the results of which are here under consideration.

Position of Station.—The observing station, including Omond House and Copeland Observatory, is situated in lat. 60° 44′ S., long. 44° 50′ W. The hourly eye observations were transferred from the ship to the shore on November 1, 1903. The land station was not quite so well situated for wind observations as at the spot where the *Scotia* wintered. This applies more particularly to westerly winds, which were deflected into southerly by some high cliffs close to the station. Winds from other directions were not so affected, and in every case the quarter from which

the lower clouds were moving was noted so as to afford a check. The instrumental equipment was as follows :—

Pressure.—A barometer of the Fortin pattern, which was placed in the living room as far from the stove as possible, with its cistern about 17 feet above mean sea-level. Two large Richard barographs, one registering on the metric, the other on the English scale. A Watkins pocket aneroid for use during excursions.

Temperature and Humidity.—A large thermograph registering in degrees centigrade, and a smaller instrument recording in Fahrenheit, were placed in louvred screens, fixed on to two stout wooden spars

Fig. 7.—Meteorological Instruments at Scotia Bay.

resting on cairns, and securely anchored to the ground by stout cables. Other screens contained two hair hygrographs of the Richard pattern, two pairs dry and wet bulb thermometers, and a maximum and minimum registering thermometer. The latter were read and set at midnight. The recording instruments were supplied with new charts every Monday morning when the clocks were wound. Occasionally during blizzards the records of the thermographs and hygrographs would be interrupted owing to fine snow drift filling up their interiors. A further source of trouble was the wet bulb thermometer at low temperatures, and it still remains to be seen how far the values at temperatures below 10° F. can be utilised.

Wind.—The direction of the wind was observed to thirty-two points until the end of February 1904, and to sixteen points thereafter, the

force being estimated on a scale of 0 to 12. A Robinson hemispherical cup anemometer was mounted on a post with its cups at a height of 7½ feet above the ground. During the fourteen months of observation at the land station three were employed, as the wear and tear on the bearings was considerable, rendering it necessary to put out a new instrument every four or five months.

Sunshine.—Until February 1904 a Campbell-Stokes recorder was alone employed for the registration of bright sunshine, but after that date the records of an instrument of the Jordan pattern were also available. Unfortunately it was not possible to obtain a site for these instruments where there was a clear horizon at all hours. In summer, hills to the west cut the solar rays off at about 7 P.M., and in winter the total possible of about five hours was reduced to half that amount by mountains to the NNE. The amount of cloud was however noted every hour, which helps to supplement the somewhat defective sunshine record.

Precipitation.—A snow gauge was placed at a height of four feet from the ground, and the amount measured every day at 10 A.M. On the rare occasions when the downfall was in the form of rain, the gaugings are doubtless accurate, but in heavy weather, with much snow, the readings were vitiated by drift.

Radiation.—A black bulb registering maximum thermometer in vacuo was fixed in a stand screwed to the top of one of the thermometer screens. This instrument was read and set daily after sunset. A terrestrial minimum thermometer was exposed when the conditions were favourable.

In addition to the above, other observations were taken during the summer of 1903-1904, special attention being devoted to obtaining records of air waves by means of a very sensitive barograph called a Statoscope, while a combined thermograph and hygrograph recording on a quickly moving cylinder gave interesting records during Föhn winds.

Hourly observations were taken, the day being divided into four watches of six hours each, and the watches changed every week. In this way any slight personal equation was eliminated.

On the *Scotia* the same arrangements obtained as were described in my previous report, except that the Robinson anemometer was dismounted when the vessel was at sea.

Meteorology of Laurie Island.

The observations at this station extend over the twenty-one months, April 1903 to December 31, 1904, but I have endeavoured by interpolation to complete values for the whole of 1903, so as to afford a comparison between the annual means for the two years.

Pressure.—The mean barometric pressure corrected to 32° and sea-level, but not to standard gravity at 45°, was 29·210 inches in 1903, and 29·330 inches in 1904. In the nine months, April to December, for which comparative observations for the two years are available, pressure was higher in 1904 than in 1903 in every month except October, when the means were the same. The excess exceeded a tenth

of an inch except in May and October. The greatest excess was 0·459 inch in November. During the twenty-one months under review mean monthly pressure was highest (29·578 inches) in November 1904, and lowest (29·105 inches) in March of the same year, showing a difference of 0·473 inch in the monthly means. The highest individual readings of the barometer were 30·122 inches on August 10, 1904, and 30·113 inches on October 3, 1903, and the lowest 27·992 inches on June 8, 1904, and 28·107 inches on October 21, 1904. The extreme range of pressure is thus 2·130 inches. The greatest monthly range was 1·994 inch in October, and the least 0·841 inch in December 1904. The seasonal values show for summer a mean of 29·197 inches, autumn 29·240 inches, winter 29·308 inches, and spring 29·337 inches. Looking at these results broadly the higher barometer in winter and spring is associated with the continental type of weather, it being at these seasons that the surrounding seas are covered with vast quantities of pack ice. Anti-cyclones cannot be said to be responsible for the higher pressures, which are probably due to the greater absence of low pressure systems. With reference to the marked excess of pressure in 1904, as compared with the year previous referred to above, it was doubtless due to the much greater extension of ice round the islands. In 1903 there was open sea but a little way to the north of the South Orkneys, whereas in 1904 the pack probably extended three degrees to the northward. To this circumstance may be attributed the strong contrast between the general weather of the two seasons. Not only was the north-westerly type of weather less frequent, but there were many spells of fine cold dry weather and clear skies. V-shaped depressions, so common in 1903, were almost entirely absent, and, generally speaking, the atmospheric conditions were much more stable than in that year.

Temperature.—The mean air temperature at a height of 17 feet above mean sea-level was approximately 23°·1 F. in 1903 and 22°·3 F. in 1904. As will be seen from the following table, large differences were apparent in the same months of the two years:—

	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1903	20°·6	17°·1	9°·5	16·9	18°·8	13·4	27°·0	29°·3	31°·5
1904	25°·1	10°·5	16·8	7°·0	12°·7	20°·5	18°·4	31°·1	28°·8

The highest mean temperature of any month was 32°·6 F. for February 1904 and the lowest 7°·0 in July of the same year, showing a range of 25°·6 in the monthly means. The absolutely highest temperature was 47°·5 on February 11, 1904, and the lowest −40° on August 3, 1904, and again on the following day, showing a range of 87°·5 between the extreme values; the greatest monthly range of temperature was 80°·2 in August 1904, and the least 15°·4 in December 1903. The mean temperature of the coldest day, August 4, 1904, was −33°·0, and of the warmest, January 9, 1904, 37°·7, showing a range of 70°·7 in the mean temperature of the days. The mean temperature of the seasons is summer 31°·4, autumn 22°·7, winter 13°·7, and spring 23°·3. The question of temperature seems to largely depend on the extent and distribution of pack round the Islands and in the Weddell Sea. Thus

October 1903 had a mean temperature of 27°·0, and we know from the experiences of the Swedish Expedition that the sea to the south and west was almost wholly free from ice. In October 1904, however, the Islands were invested with heavy pack, and the mean temperature was 18°·4 or 8°·6 lower than in the year preceding. The differences due to the presence or absence of ice are naturally less marked in summer than at any other season. Thus in December 1903 there was open water all round the Islands, and the mean temperature was 31°·5, but in the same month of 1904 there was much pack, and the mean was only 28°·8, a very low value for the month which corresponds to that of June in the northern hemisphere.

"Föhn" winds are, however, quite independent of the ice conditions. They only take place with winds from WNW., in which direction there is a considerable area of high land over which the air has to pass before reaching Scotia Bay. The descending current warmed dynamically by compression may produce as high a temperature in midwinter as in midsummer. Thus on May 31, 1903, the shade thermometer at 1.15 P.M. rose to 46°·8, while, as already stated, the absolute maximum was 47°·5 on February 11, 1904. On this day the *Scotia* at noon was in lat. 55° 35′ S., long. 54° 5′ W., being then over five degrees of latitude to the north of the Orkneys, but while the "Föhn" was blowing lower temperatures were recorded on the ship than at the Island. The following are the readings of pressure, temperature, and wind at 3, 4 and 5 P.M. on the day referred to:—

	South Orkneys			Scotia		
Hour.	Pressure Inches.	Temp.	Wind.	Pressure Inches.	Temp.	Wind.
3 P.M.	29·187	45·9	NW.	29·529	42·9	WNW.
4 P.M.	·201	46·5	NW.	·509	41·3	WNW.
5 P.M.	·206	47·0	WNW.	·482	42·0	WNW.

The barometric readings are reduced to 32° and sea-level, and the wind direction is true. The observations are not quite synchronous at the two positions, which differ nearly 10° of longitude, but the purely local effect of the "Föhn" is well marked. That the phenomenon is quite local and not associated in any way with the temperature of surrounding areas is shown by the circumstance that as soon as the wind changed to NW. by N. the temperature invariably fell. A few notes made at 5 P.M. on the day above mentioned indicate the restricted area over which the "Föhn" effect prevailed. At this hour Cape Bennett, twelve miles west of the station, and the horizon beyond, were quite clear, but in the direction of Saddle Island, some seven miles due north, the view was restricted to above five miles. This shows the extent to which the dry Föhn wind extended in a north-west direction. At this time the upper sky was three-fourths covered with beautiful cirrus and cirro-cumulus clouds travelling very quickly from the NW.

An increase of temperature with height was not uncommon under anti-cyclonic conditions. Thus on August 19, 1904, the temperature at 11 A.M. at a height of 896 feet was 20°·6, while at sea-level at the

same time it was 10° 4. Many such inversions of the normal conditions were observed, and it is very probable that the large inversions of temperature observed in Europe during anti-cyclones would manifest themselves. Unfortunately the kite experiments were not a success, and the ascent of lofty peaks was out of the question owing to crevasses and hanging glaciers, so no data were obtained from heights exceeding 1400 feet.

Sunshine and Cloud.—The total amount of sunshine recorded by the Campbell-Stokes sunshine recorder was 516 hours in 1903 and 463 hours in 1904. The number of sunless days amounts to 180 per annum. The mean amount of cloud (overcast sky or fog equal to 100) comes out 82 for both years. The cloudiest month was January 1904, with 96 per cent. of obscured sky, and the clearest month August 1904, with 66 per cent. The seasonal means are, summer 93, autumn 82, winter 73, and spring 81. Summer is thus characterised by almost continuously overcast skies, and the finest and clearest weather occurs in winter. The longest spell of absolutely cloudless weather was for the sixty-two hours terminating at 7 A.M. on August 23, 1904. The only days without cloud were September 2, 1903, August 4, 21, and 22, 1904, and September 24, 1904. Completely overcast days number 92 per annum, and are most common in summer and early autumn. On the other hand, in winter, there are few days on which the sky does not clear at some hour of the day.

Wind Velocity.—Owing to the circumstance that an analysis of the hourly wind directions is not yet available no detailed statement on this point can be made. Speaking broadly, it may be stated that the prevailing wind directions are NW. and WNW. In the winter and spring of 1904, however, winds from the south-west and south were much more frequent than in the year previous. The mean hourly velocity was 13·3 miles in 1903 and 15·0 miles in 1904, the highest mean hourly movement being 20·0 miles in April 1904, and the lowest 8·8 miles in January 1904. Spells of quiet weather are much more frequent than one would expect, but on the other hand a notable feature was the fierce squally weather which at times continued for days together.

Precipitation.—The precipitation, which for nine months of the year is chiefly in the form of fine granular snow, amounted during the year 1904 to 10·41 inches. This statement must however be received with caution, as the amount is liable to be vitiated by drift off the surrounding hills. On the other hand, the snow was frequently carried in a horizontal direction over the mouth of the gauge and the record lost. On the whole I incline to the belief that the above amount is somewhat in defect, and that the annual mean may be put at about 15 inches, of which 35 per cent. falls during the three summer months, December to February.

Auroras and Thunderstorms.—It is somewhat remarkable that in the two years 1903 and 1904 not a single case of the aurora was observed at the South Orkneys, and it is interesting to note that none were reported by Nordenskjöld at Cape Seymour, or by Charcot at Wandel Island, so that auroral displays must be of infrequent occurrence in the

Weddell Sea and Graham's Land areas. Distant lightning was seen on September 23 and 25, 1903, and thunderstorms occurred on August 8 and October 20, 1904.

The miscellaneous meteorological and optical phenomena observed during the second year were very similar to those seen during the first winter which have been described in this *Magazine*.[1]

The Meteorology of Laurie Island, South Orkneys, compared with the Meteorology of the Weddell Sea and South Atlantic, February 21 to April 20, 1904.

The *Scotia*, as already stated, left Laurie Island, South Orkneys, on February 22, 1904, on her second cruise into Antarctic waters. During this time hourly observations are available for comparison with similar data from the South Orkneys. It is not possible at this stage of the inquiry to go with any degree of elaboration into the many questions of interest resulting from a discussion of these simultaneous observations, but a summary of some of the more important data may be of interest. I have divided the period under discussion as far as possible into groups of ten days (see Table II.). The more intimate relations prevailing between the weather conditions in this region and adjacent places will doubtless be shown by the daily weather charts for the southern hemisphere south of 30° S., which are being prepared by the London Meteorological Office and the Deutschen Seewarte. It was particularly fortunate that during this time Dr. Charcot of the French Expedition was at work in the Graham's Land area to the west and south of the South Orkneys Islands, so that much light will ultimately be thrown on the development rate of motion and inter-relationship existing between cyclonic and anti-cyclonic systems in this part of the Antarctic. Further information will also be available from a comparison of these weather changes with those prevailing in South America, there being an excellent daily weather map of this region issued by Mr. Davis, director of the Argentine Meteorological Office. The base station at Cape Pembroke, Falkland Islands, and records from vessels passing round Cape Horn, will also aid materially in the elucidation of what is a most interesting and important investigation.

The additional data collected by the maritime department of the Argentine Meteorological Office, along with the observations from the southern parts of Cape Colony, will also furnish valuable supplementary material.

The weather conditions experienced by the *Scotia* after leaving the Orkneys, during the nine days ending with February 29, were a mean barometric pressure of 29·030 inches, a mean temperature of 29°·0, with an excess of southerly and south-westerly winds; cloud averaged 8·5 on a scale of 0 to 10, and the sea temperature was 30°·7. For these nine days the mean position of the ship was lat. 64° 08′ S., long. 36° 16′ W. At the Orkneys during this time pressure was 0·043 inch, and tempera-

[1] Vol. xx. p. 118.

ture 1°·3 higher, while the mean amount of cloud was 3 per cent. greater. The first pack ice was met with by the *Scotia* on February 26, when in lat. 65° 59′ S., long. 33° 06′ W. During the first ten days of March, when in a mean latitude of 72° 39′ S., long. 21° 17′ W., barometric pressure had declined to 28·789 inches, while the mean temperature had fallen to 24°·8. A hard easterly gale set in on the early morning of the 7th when off the ice barrier of Coats Land in lat. 74° 01′ S., long. 22° 00′ W., accompanied with thick driving snow and a low temperature, constituting a perfect blizzard. This continued till 7 A.M. of the 9th. Temperature fell rapidly, and at midnight on the 10th was down to 8°·8. During the period under review pressure at the Orkneys was 0·286 inch, and temperature 9°·0 higher, while the temperature of the sea was 3°·4 higher. During the ten days ending with March 20, when in practically the same position as during the first ten days of the month, the mean temperature was 20°·4, and the extremes 29°·8 and −0°·3. Mean pressure increased to 29·200 inches, and the prevalent winds were from NW. to NE., with a considerable percentage of calms, which accounts for the low wind force. At the Orkneys during this time pressure was 0·019 inch lower, but temperature 12°·0 higher than in 72° 22′ S., showing a decrease of temperature with latitude equivalent to 1° of temperature for each degree of latitude. The temperature of the sea was 3°·6 higher than at the southern station. During the last eleven days of March the *Scotia* was in a mean latitude of 66° 22′ S., long. 12° 7′ W., the mean temperature had risen to 29°·4, pressure had fallen to 29·031 inches, and the winds were almost wholly from N., NW., and W. At the Orkneys during this time pressure was 0·030 inch higher, and temperature only 1°·6 higher, the thermal conditions, despite a difference of nearly 6° of latitude, being much the same at the two places. The very large differences of temperature noted during the first three weeks of March were thus due to the continental influence exerted by Coats Land, off which the vessel was beset most of the time, and also to the presence of much pack ice. During the last eleven days of March, however, no pack was met with, and the mean temperature of the sea rose to 31°·3 against 32°·7 at the Orkneys. It is unnecessary to go at length into the conditions experienced by the *Scotia* on her voyage to Gough Island. During the first twenty days of April a series of heavy north-west gales were met with, and high seas.

In connection with the very heavy south-east gale experienced at the South Orkneys on April 4, it may be of interest to compare the conditions on the *Scotia* with those prevailing on the island. On March 31, the *Scotia* being in lat. 60° 37′ S., long. 12° 16′ W., a heavy northerly gale set in at 5 P.M., which continued till 5 A.M. of April 1. Pressure fell from 29·551 inches at 5 A.M. of the 31st to 28·117 inches at 1 P.M. of April 1st. At the South Orkneys, 940 miles due west of the above position, the barometer remained relatively high and steady, the mean pressure on April 1 being 29·382 inches, against 28·283 inches on the *Scotia*. After this deep depression pressure over the region traversed by the *Scotia* continued to rise slowly and irregularly till about 7 A.M. on April 4, being then 29·715 inches, but at the Orkneys the barometer

by midnight of the 3rd had fallen to 28·216 inches, and rose slowly on the 4th and 5th, accompanied by a terrific south-easterly gale. On the *Scotia* pressure fell rapidly on the 4th, reaching a minimum of 28·492 inches at 6 A.M. on the 5th. At noon on this day the *Scotia* was in lat. 55° 25′ S., long. 13° W., and as a heavy northerly gale blew during the 4th and 5th, the centre of the depression was to the west and south of the *Scotia*, but north of the latitude of the Orkneys. The mean rate at which the cyclonic storm progressed was about 30 miles per hour.

An interesting point regarding these deep depressions of the southern hemisphere is the very rapid fall of the barometer in the front and the slow increase of pressure in the rear of the disturbance—the rapid fall being associated with light winds, but as soon as the centre has passed the wind increases to a heavy gale.

It will be seen from a comparison of the observations on the *Scotia* while in the Weddell Quadrant, with those taken on the South Orkneys, that there is less cloud over the open sea in summer than at the Islands, a point which will have to be considered in drawing Isonephs for these regions.

It will further be observed that north of 60° S. the temperature of the air approximates closely to that of the surface temperature of the sea, and that the wind force increases rapidly after leaving the above latitude. I incline to the belief that during the summer and early autumn there is, between 60° and 70° S. latitude, little difference in the mean temperature of the air over the open sea. The barometric gradients are also slight, and light winds prevail in general with dull weather and occasional showers of snow and sleet. It is otherwise, however, between the parallels of 50° and 60° south; here there is a rapid rise both in air and sea temperature—the rise in the latter increasing still more rapidly as we proceed north of 50°. In winter the thermal gradient must be exceedingly steep in the neighbourhood of the Orkneys. Thus at Ushuaia, in Tierra del Fuego, lat. 54° 52′ S., long. 68° 07′ W., the lowest temperature in ten years was 11°·1, at South Georgia, in lat. 54° 31′ S., long. 36° W., the minimum observed during 1882-1883 was 9°·9, while at the South Orkneys, but little more than 6 degrees to the south, a temperature of 40° below zero has been recorded, while the mean annual temperature there is 12° lower. One of the most powerful factors in determining the temperature of the air over the South Atlantic is the Antarctic current, bringing with it streams of ice and numerous icebergs. The direction of this current at the Orkneys is approximately ENE., bending more to the north-east about the meridian of the Sandwich Group, and carrying ice-cold water as far north as Bouvet Island, and that in the southern summer and in a latitude like the northern part of England.

In the elucidation of the problems of atmospheric circulation in that portion of the Antarctic area known as the Weddell Quadrant or from the meridian to 90° W., many valuable data are at present under discussion. The report of the *Belgica* Expedition has been already published, and the discussion of the observations taken by the Swedish, French, and Scottish Expeditions is well under weigh, so that in a com-

paratively short time it will be possible to formulate a first approximation regarding the meteorological and oceanographical conditions prevailing in this portion of the Antarctic regions.

Magnetism.

The magnetic observations commenced soon after the arrival of the *Scotia* in winter quarters. The observations were carried out in a hut, to which the name of Copeland Observatory was given, erected on the narrow beach on which Omond House stands. The instruments employed were a Kew portable unifilar magnetometer for determining the absolute horizontal force and declination, and a Barrows dip circle for determining

Fig. 8.—Omond House from Scotia Bay, and meteorological instruments. Mount Ramsay, Jessie Bay, in background.

the absolute dip or inclination. The constants of the magnetometer were determined at Kew before the departure of the Expedition, and again at the Magnetic Observatory of Pilar (province of Cordoba), Argentina, in March of this year. The station was handed over to the Argentine Meteorological Office in February 1904. Up to this time the observations taken included 25 sets of dip, with 2 needles, 33 sets of horizontal force, and about 65 determinations of absolute declination, including hourly eye observations of declination on twenty days. During the autumn and winter of 1904 I continued to make such observations as were necessary to keep up the continuity of the record, but beginning with September 1, two complete sets were made every week and continued up till the end of the year. The observations from March to December 1904 have been worked up by Dr. Schultz, late director of the Pilar Observatory, and will appear shortly. This year the magnetic work at the South Orkneys has been extended, a self-recording apparatus

or system of variometers for registering the diurnal variations in the declination, horizontal force, and vertical force, having been installed in January.

Tidal Observations.

Soon after the freezing in of the *Scotia* at the end of March 1903, half-hourly tidal observations were initiated, and continued for about five months. The apparatus used consisted of a long wire fixed to the sea bottom, which is here ten fathoms from the surface, by means of a heavy weight. This wire was carried over a davit by means of a pulley. At the extremity of the wire was another but lighter weight, which rose and fell with the tide along a graduated wooden scale. The floe in which the *Scotia* was frozen rose and fell with the tide, the height of which was thus shown by the varying elevation of the weight attached to the wire passing over the pulley. These observations are at present being worked up, and, owing to the peculiar importance attached to data from the Antarctic Ocean, should furnish a valuable contribution to the dynamical theory of the tides.

TABLE I.—Showing Mean Monthly Values at Scotia Bay, Laurie Island, S. Orkneys, from April 1903 to December 1904, Lat. 60° 44′ S., Long. 44° 50′ W.

From Hourly Eye Observations.

	Barometric Pressure.[1]	Air Temperature.	Cloud.	Sunshine.	Wind Velocity.
1903.	Inches.	°	0-10	Hours.	Miles per Hour.
April,	29·204	20·6	8·1	...	11·6
May,	·329	17·1	7·5	26·7	15·4
June,	·256	9.5	6·7	3·7	13·5
July,	·160	16·9	7·5	12·1	17·5
August,	·254	18·8	8·1	35·7	15·4
September,	·239	13·4	7·0	75·5	11·6
October,	·337	27·0	8·4	58·5	14·6
November,	·119	29·3	8·4	89·4	11·7
December,	·201	31·5	9·3	73·3	9·0
1904.					
January,	·158	32·3	9·6	49·0	8·8
February,	·144	32·6	8·8	45·7	15·0
March,	·105	32·4	9·2	20·4	19·2
April,	·338	25·1	8·3	25·8	20·0
May,	·358	10·5	6·9	27·1	14·9
June,	·406	16·8	7·6	6·2	13·9
July,	·291	7·0	6·9	7·2	11·8
August,	·479	12·7	6·6	43·2	13·2
September,	·413	20·5	7·2	69·3	15·7
October,	·335	18·4	8·8	64·9	14·7
November,	·578	31·1	9·1	49·8	17·3
December,	·334	28·8	9·5	54·8	15·5
Means, 1904,	29·328	22·3	8·2	463·4	15·0

[1] Corrected to 32° and sea-level but not to Standard Gravity at latitude 45°.

TABLE II.—Showing the Meteorological Conditions experienced in Weddell Sea and South Atlantic, February 21 to April 20, 1904.

A.—Laurie Island, South Orkneys. B.—Scottish National Antarctic Expedition.
From Hourly Eye Observations.

A. LAURIE ISLAND, SOUTH ORKNEYS.

Period 1904.	Position at Noon.		Barometric Pressure at 32° and Sea-Level.				Air Temperature.						Wind.	Cloud.	Surface, Sea Temp.
	Mean S. Lat.	Mean W. Long.	Mean.	Highest.	Lowest.	Range.	Mean.	Mean Max.	Mean Min.	Mean Daily Range.	Highest Observed.	Lowest Observed.	Mean Force 0-12.	Mean Amount 0-10.	Mean.
	° ′	° ′	Ins.	Ins.	Ins.	Ins.	°	°	°	°	°	°			°
Feb. 21-29	60 44	44 50	29·073	...	...	...	30·3	32·2	28·2	4·0			2·0	8·8	..
March 1-10	,,	,,	29·075				33·8	37·0	33·3	6·7			2·5	9·4	33·0
,, 11-20	,,	,,	29·181	29·713	28·280	1·433	32·4	34·6	30·3	4·3	39·9	20·8	1·8	9·1	33·0
,, 21-31	,,	,,	29·061				31·0	33·5	28·0	5·5			2·5	9·2	32·7
April 1-10	,,	,,	29·245	30·110	28·216	1·894	26·9	30·1	23·3	6·8	..	..	2·5	8·7	31·6
,, 11-20	,,	,,	29·656				27·9	32·7	24·4	8·3	...	...	2·1	7·6	31·3

B.—SCOTTISH NATIONAL ANTARCTIC EXPEDITION.

1904.															
Feb. 21-29	64 08	36 16	29·030	29·394	28·762	0·632	29·0	30·6	28·0	2·6	31·8	25·9	1·7	8·5	30·7
March 1-10	72 39	21 17	28·789	29·388	28·237	1·151	24·8	26·8	21·7	5·1	30·6	8·8	3·7	9·3	29·6
,, 11-20	72 22	20 45	29·200	29·708	28·760	0·948	29·4	24·6	15·2	9·4	29·8	0·3	1·6	8·5	29·4
,, 21-31	66 22	12 7	29·031	29·637	28·142	1·495	29·4	30·6	28·2	2·4	32·0	25·5	3·0	8·4	31·3
April 1-10	54 56	10 19	29·257	29·890	28·117	1·773	34·0	36·1	31·9	4·2	41·4	25·5	1·5	7·5	34·1
,, 11-20	45 32	9 36	29·539	29·931	28·704	1·227	44·2	48·5	41·9	6·6	57·3	31·5	4·2	8·1	45·9

SHOWING THE NUMBER OF HOURS OF DIFFERENT WINDS (TRUE) SCOTTISH NATIONAL ANTARCTIC EXPEDITION.

1904.	N.	NNW.	NW.	WNW.	W.	WSW.	SW.	SSW.	S	SSE.	SE.	ESE.	E.	ENE.	NE.	NNE.	Calm or Var.
Feb. 21-29	4	0	7	6	8	3	60	18	31	19	27	4	3	1	6	0	16
March 1-10	22	16	28	9	13	7	12	4	1	1	6	10	43	10	14	8	6
,, 11-20	12	8	33	21	9	10	19	16	14	2	0	0	10	18	29	11	22
,, 21-31	56	14	40	10	78	12	11	0	5	0	2	1	6	0	12	2	15
April 1-10	30	7	100	33	30	5	24	1	0	0	0	0	2	0	4	0	4
,, 11-20	28	8	48	13	12	2	23	3	9	2	25	1	21	5	10	0	0

5. DIEGO ALVAREZ, OR GOUGH ISLAND.

By R. N. Rudmose Brown, B.Sc.

(With Map and Illustrations.)

It is somewhat remarkable that an island lying in so low a southern latitude as that of the Cape, and almost on the track of sailing-ships outward bound *via* the Cape of Good Hope, should have remained practically unexplored until the present.

But this is the case with Diego Alvarez, or Gough Island, to which the Scottish National Antarctic Expedition paid a visit in April 1904 on their way from the Antarctic Seas to Cape Town. Our previous knowledge with regard to the island was very meagre, and consisted of a few casual notes in the voyages of sealers and a few remarks as to its configuration by one or two men-of-war, enterprising enough to have wandered off their routine tracks. The remote position of the island may have been largely responsible for this, as it lies some 1500 miles W. by S. of the Cape of Good Hope, which is the nearest land except for Tristan da Cunha, distant about 280 miles N. by W. : it is some 2000 miles N. by E. from Cape Horn. The island is about 8 miles in length, lying NNW. and SSE., and about 4 miles broad, narrowing towards its north-western and southern limits. It is one of the peaks of the mid-Atlantic ridge, which probably makes its most southerly appearance above the surface of the ocean in Bouvet Island. The latitude and longitude of the *Scotia's* anchorage, as determined by Captain T. Robertson, was 40° 20′ S. 9° 56′ 30″ W. The position determined by H.M.S. *Royalist* (40° 19′ 11″ S. 9° 56′ 36″ W.) for Penguin Island, a little to the NNE. of the *Scotia's* anchorage, agrees with this.

After long battling with contrary winds the *Scotia* arrived off the island on April 21, 1904, and remained there for three days, on only one of which, however, was landing at all practicable. The visit, brief as it may have been, was nevertheless of great importance, as it enabled collections and observations to be made which were much to be desired from this island—which, with the exception of some more strictly Antarctic Islands, was the last unexplored island in the Atlantic. Before giving some account of the island as we found it, it will be of interest to summarise what was hitherto known concerning it. Most of the previous information dealing with Gough Island[1] contained, as might be expected, few facts sufficiently definite to be of scientific importance, but some of the observations as to anchorages, etc., will no doubt prove of value to future explorers of this interesting island.

The original discoverers of the island were apparently the Portuguese —probably in the sixteenth century, which was the era of Portuguese voyagers—and they named it Diego Alvarez. In 1731 Captain Gough, in the ship *Richmond*, sighted an island in the South Atlantic which

[1] The Colonial Office inform me that Gough Island is officially recognised as British, but can give no account of the origin of this claim or the grounds on which it is sustained.

received his name, but in charts and atlases published during the next half century[1] both islands appear; and in all Gough Island is placed considerably to the east of Diego Alvarez Island, which itself is rather

far to the west in some of these early maps. It is quite probable that Captain Gough was some degrees wrong in his longitude, and that his reported island was actually Diego Alvarez Island: but on the other hand it is not impossible that he mistook cloud appearances or even an

[1] See, for example, *A New Atlas of the Mundane System*, by Samuel Dunn. London, 1778.

iceberg for land, and that Gough Island, as named by him, is not existent. The island evidently received the name of Gough Island on the supposition that it was distinct from Alvarez Island, and when it was proved that there was in reality but one island, both names were applied to it, but undoubtedly Diego Alvarez (or simply Alvarez) Island has the claim of priority.

In 1811 it was sighted by H.M.S. *Nereus*, and Captain Heywood fixed the summit of the island as 4380 feet. He gives directions as to the best landing-place, but is certainly wrong in describing the landing as safe and easy. It would seem that sealers had visited the island previously, as he found traces of their huts, but says that "most of the seals have deserted the island: but plenty of fish were procured and birds of good flavour were caught by lighting a fire upon one of the hills at night." Other American sealers visited Gough Island again in 1825, but met with so little success that they soon left again.[1] It was next visited by Benjamin Morrell[2] in the *Antarctic* in November 1829. Much doubt has at times been cast on the statements of Morrell, and though he does at times record very extraordinary events, his remarks on Gough Island are very commonplace and quite credible. He gives directions for obtaining water by running "the vessel close in to the front of the cove, where she can anchor in twelve or fourteen fathoms, with the huts at the head of the cove bearing SSW., and the north and eastmost island bearing about NW." This cove he points out lies "on the north side of the island a little to the eastward of one of the rocky islands." From the *Scotia* we did not make out any safe anchorage at the north or any marked cove with huts on that side, but it is possible that during certain winds boats might lie there, and as regards the huts, later voyagers have mentioned there being some there. The rocky islands Morrell mentions and Church Rock were easily made out. Morrell also complains of the scarcity of seals and sea-elephants. The first visit to Gough Island that resulted in any definite information was that of H.M.S. *Royalist* in 1887,[3] during which Lieutenant J. P. Rolleston made a rough survey of the island, which is here reproduced from the Admiralty chart (2228) with some additions. Only two maps of Gough Island have been published, and this one of Lieutenant Rolleston is far the more accurate. The other, which appears in some charts, is a plan of the eastern side of the island, and is very far from correct. In fact it is so misleading that little reliance should be placed on it.[4] The place where the *Scotia* party landed is the one shown on the chart, and it certainly seemed at the time of our visit to be the only possible one.

In the end of 1887 the schooner *Francis Alleyn* of New London left

---

[1] *The Fisheries and Fishing Industries of the United States.* G. Browne Goode, vol. ii. p. 415 (1887).

[2] *A Narrative of Four Voyages to the South Seas, etc., from* 1821-1831. Benjamin Morrell. New York (1832), p. 355.

[3] *Africa Pilot.* Pt. ii., Hydrographic Office, London, p. 200.

[4] This plan, I am informed, is taken from "*Mouillage de l'Ile Gough.* Levé en 1813 par M. M. Richardson et Fitz-Maurice de la Marine Royale Anglaise." The original publication I have not seen.

a party of five sealers on Gough Island while she went further afield. They appear to have had little success, and remained there, with some additional men landed in August 1888, until January 1889 in the hope of increasing their catch. Their landing-place was also the mouth of the glen. This visit is of great interest, as one of the men, the second mate, George Comer, had evidently some taste for scientific pursuits beyond the general curio-hunting tendencies of the average sailor, and he not only made a small collection of bird-skins and eggs, but kept a meteorological log during his whole stay on the island from August 1888 to January 1889. Comer's general diary contains much interest-

Fig. 9.—Gough Island, North-east point looking NNW. Church Rock in foreground.

ing information about Gough Island.[1] During the fifteen months that the *Francis Alleyn's* party spent on the island they seem to have killed 311 seals (*Arctocephalus australis*), and only one sea-elephant (*Macrorhinus leoninus*). Whales are mentioned, but no indication of the kind; many birds are recorded, and the men apparently lived largely on penguin eggs; mice even then were numerous, and overran the island. Potatoes growing wild, but quite eatable, were found in a place where they landed, at which "there used to be a camp of sealers years ago." This may be the cove Morrell refers to on the north side. The weather, from

[1] *On Some Birds and Eggs collected by Mr. Geo. Comer at Gough Island, Kerguelen and South Georgia*, etc., by G. E. Verrill. *Trans. Conn. Acad.*, vol. ix., pt. ii. (March 1895). To this paper I am indebted for the observations of Mr. Comer on Gough Island.

Comer's log, was very unpleasant, with a frequency of gales and an excessive rainfall, while fogs were common. As the log was kept during summer severe weather would hardly be expected, yet he records how one of the men was lost in a snowstorm and frozen to death in crossing the hills in October. At the head of the glen his grave is still marked with a board inscribed "José Gomez, perished in the snow." Comer apparently took no air-temperatures, but he has noted the temperature of the sea in many of his observations.

The next recorded visit to Gough Island was made by the Cape Town sealing schooner *Wild Rose*. A party of men was landed about the end of January 1891, and remained until about February 1892, living at the same station at the seaward end of the glen. For much interesting information concerning their year's stay I am indebted to Mr. Fred Andrews (now of Dyers Island, Cape Colony), who was one of the party, and who has kindly placed at my disposal a rough map and several sketches made by himself. His diary kept during his sojourn on Gough Island was unfortunately lost in a fire that destroyed the huts on the eve of his departure. Sealing was again the object of the stay, but the result was rather disappointing. The seals have either been exterminated or have left the island, only a few being found in 1891 on the west and north sides of the island, and none on the east; and of sea elephants, much sought after for their oil, only one was obtained. The party began to boil down penguins for oil, but, fortunately for the continuance of the species, abandoned the operation after a few weeks. According to Mr. Andrews, "right whales from May 1st come inshore to rub off the barnacles close to the fresh-water streams"; but in the light of the negative evidence as to the present existence of a right whale in these seas, it seems more than probable that he mistook the species. It is interesting to find that "at the north beach," which from Mr. Andrews' plans is evidently the place Morrell speaks of, potatoes were to be found growing wild, but of little value for food, and also cabbages in the same condition. The cabbages which Mr. Andrews planted at the glen station in 1891 were, however, not to be found at the time of the *Scotia's* visit. Mice are again mentioned as being numerous. Mr. Andrews speaks of hard frost and heavy snow during the winter, and considers Gough Island a place unequalled in his experience for rainfall. Of importance also to future explorers of the island are his statements concerning a harbour, which went by the name of Snug Harbour, at the southern end of the land. From his descriptions the anchorage, which can only accommodate boats or small vessels, lies between two large rocks known as Castle and Battery Rocks. Here landing can be made and access obtained to the higher ground, whence the glen can be reached without much difficulty.

This would apparently exhaust all that has been recorded about Gough Island until the Scottish National Antarctic Expedition arrived there on 21st April 1904. From various accounts of the relatively well-known and not far distant island of Tristan da Cunha, we were quite prepared to find the island somewhat unattractive and even desolate in appearance, and were pleasantly surprised instead to find it beautifully

clothed in green from the water's edge to almost the summit, and to see the numerous cascades of water pouring out of the hanging valleys and leaping over the sheer precipices some hundreds of feet into the sea. The island is very precipitous, and in most places rises sheer up from the sea in cliffs some 200 feet, increasing to nearer 1000 towards the northern end. Above these cliffs the ground slopes more gradually up towards the summit, which was estimated by Heywood in 1811 to be 4380 feet. Towards the south-west end of the island there appears to be a more or less level plateau of about half a square mile in extent at an elevation of some 300 feet, but everywhere else the island seems to rise into steep ridges separated by narrow glens. At the foot of many of

Fig. 10.—Gough Island, South point from the East.

the cliffs is a narrow strip of beach or rocks at low tide, but it is only at a few places that access can be had to the interior. At the seaward end of the glen on the east side, in a small cove bounded at the south by a curious tunnelled rock, is the best landing-place. It is here that most of the shore parties have lived, whose ruined huts are still to be seen. The glen runs into the interior from this cove, and affords a ready means of penetrating the island. Lieutenant Rolleston's chart is in error in showing this glen to be over a mile wide at the mouth; at the most it is some 200 yards. A settlement here would have some shelter from most directions except east, while the torrent would yield a good supply of fresh water, and about an acre of level ground could be used for the cultivation of vegetables, or even for grazing. The trees, which abound all along the glen and up its sides, would afford firewood,

as they have evidently done in the past. From Snug Harbour, according to Mr. Andrews, it is also practicable to explore the island, and at his "north beach" huts could be built. On the western side, which must generally be too exposed for landing, Mr. Andrews speaks of three beaches—Seal Beach, Elephant Beach, and Jonathan Beach—and from some of Comer's statements in his diary, it is probable that these can be reached overland from the eastern side. As regards anchorage for a fair-sized ship, there is really no good one, for the water deepens rapidly and the holding ground is bad, so that, with the fierce squalls that seem to generally prevail from the high land, a ship is very liable to drag her anchors and blow out to sea. The *Scotia* anchored the

Fig. 11.—Gough Island, near the Mouth of the Glen ; *Scotia* seen through the cave.

greater part of a day in 15 fathoms about one mile off the land abreast the glen, but the bottom was very hard, and probably she was only enabled to remain there as the weather was comparatively quiet. The *Royalist* in 1887 apparently found anchorage just north of Penguin Islet in 17 fathoms, soft sand, but certainly during the *Scotia's* visit this anchorage would have been untenable.

The following remarks on the general structure and geology of the island, by Dr. J. H. Harvey Pirie, may be included here : "In its general appearance from the sea this island reminds one rather of Madeira, in its bold jagged outlines and steep slopes and cliffs cut deeply into by ravines. It differs, however, in the extreme height and steepness of the cliffs, which almost all round come sheer down to the sea without any intervening gradual slope. In this respect the island greatly resembles

St. Helena. This slope would appear to be even greater under water, for at a distance of three miles from the coast a depth of 1322 fathoms was obtained.

"The cliffs bear witness to the rapidity with which the coastline is being eaten back by the waves—at a rate seemingly much greater than that of the sub-ærial denudation, for most of the stream valleys have their courses truncated sharply by the sea cliffs. Most of the streams, therefore, end as cascades, tumbling down from the hanging valleys into the sea.[1] A few of the streams, notably that one entering the sea at the landing-place on the east, have a deeper course, and have excavated valleys running right into the heart of the island. There has been a recent slight alteration of sea-level in favour of the land, for numerous sea-caves are to be seen along the east and south coasts which appear to be about 10 to 15 feet above the present sea-level, and the ground on which the huts were built is a small raised beach of coarse pebbles through which the stream has cut a bed.[2] The highest parts of the island appear to be of the nature of a ridge cut into two slightly separated summits. Through a glass conspicuous horizontal terracing is to be seen, and in the photograph already referred to one of these terraces can be seen standing out against the skyline.

"If these are due to lava sheets, as seems the most probable explanation, one must be prepared to admit a former much greater extension of the island. It is even possible that at one time it has been continuous with Tristan da Cunha. The almost certain previous union of this latter island with Inaccessible Island—although now separated by water 1000 fathoms deep—makes this hypothesis even more likely.

"The stream, at the mouth of which is the ruined settlement, forks some way inland, and from the ridge between the two tributaries, but some distance below the summit of the island, there rises up a large rounded column known as the Apostle. This has a darker colour than the surrounding rocks, and appears to be quite bare of vegetation.[3] Without closer inspection it is impossible to be sure of its nature; it may be either the stump of an old volcanic neck or of a 'Tower of Pelée.' On the other hand, it may be of the nature of one of the phonolite bosses which are so common in South Atlantic Islands—*e.g.* 'Lot' and 'Lot's Wife' at St. Helena, the Peak at Fernando Noronha, and the Ninepin Rock on South Trinidad.

"So far as is known, the rocks are entirely of volcanic origin, and on some of the cliffs as well as near the summit horizontal sheets of rock were observed, and these had a transverse columnar structure. At the landing-place the rock was more of a fragmental character, coarse agglomerate, and there was also a fine yellowish water-laid peperino studded with augite crystals. The massive rock was mostly of andesitic nature. Dykes do not form very prominent scenic features save in one

[1] One of these hanging valleys is shown in this *Magazine* for January 1905 (p. 30), "Second Antarctic Voyage of the *Scotia*."

[2] It is interesting to note that in the South Orkneys there has also been a recent elevation of about the same extent.

[3] See illustration in this *Magazine*, January 1905, p. 29.

of the hanging valleys near the north-east corner of the island, where large detached wall-like pieces stand out prominently on both sides of the valley. One solitary piece of coral limestone with quartz pebbles was picked up on the beach, but little importance can be attached to this, as it may have been brought there by human agency. Had it been found *in situ* in the agglomerate it would have told a different story."

Mr. W. Eagle Clarke, who has published an account of the birds collected at Gough Island,[1] records twenty-three or twenty-four species. The Scottish Antarctic Expedition collected nineteen of these, adding twelve to the avifauna. Twelve species were previously known from the collections of Comer[2] in 1888. Of the collection of the Scottish Expedition two, and possibly three, are new to science, viz. a green and an orange-buff bunting (*Nesospiza goughensis* and *N. jessiae*) and a species of *Thalassogeron*. The two buntings, and a brilliant black-red and yellow gallinule (*Porphyriornis comeri*), also endemic, are the only land birds of the island. The two genera also are restricted to the Tristan da Cunha group. The majority of the other birds are Tubinares except the penguin (*Eudyptes chrysocome*), of which there were still some on land at the time of the *Scotia's* visit, despite the lateness of the season. The only mammal on the island is a mouse introduced by some settlers and often mentioned by previous visitors as being far too abundant. Mr. Eagle Clarke, who has kindly examined a specimen, informs me that it is the typical *Mus musculus*, and even though it has been isolated so long on Gough Island, appears not to have diverged at all from the norm of the species.

A number of insects were found, including beetles, and several kinds of flies, but these are not yet determined. We took four or five hauls of the dredge off the coast, and one in 100 fathoms was particularly rich, while others in 25 fathoms secured many species.

All who have landed on Gough Island comment on the denseness of the vegetation in most parts, and the consequent difficulty in moving over the island. This is mainly due to the thick tufts of tussock grass (*Spartina arundinacea*), which grows in abundance over all the lower ground, and the gnarled and stunted trees (*Phylica nitida*), which extend from sea-level to almost two thousand feet, growing even on the most exposed ridges. Another characteristic plant in the damper parts of the glens is the tree fern (*Lomaria boryana*). The common wild celery of the southern temperate zone (*Apium australe*) grows luxuriantly, and the southern American crowberry here finds its eastern limit. The flora[3] as at present known contains seventeen species of flowering plants, ten species of ferns, ten mosses, three hepatics, seven lichens, and one fungus, besides several small algæ, and on the whole, as might be expected, is very similar to that of Tristan da Cunha, Inaccessible, and Nightingale Islands, and while it shows the same general affinities, has perhaps a

[1] *On the Birds of Gough Island, South Atlantic Ocean.* By W. Eagle Clarke. *The Ibis* (April 1905), pp. 247-268.

[2] *On the Birds of Gough Island*, etc. G. E. Verrill (*loc. cit.*).

[3] The flora is at present in the course of publication. See R. N. Rudmose Brown, *The Botany of Gough Island, Journal Linn. Soc. Lond.* (1905).

stronger American element among it than other islands of the group. The flora includes three new species, one of which (*Cotula goughensis*), has an allied species endemic to Nightingale Island, while several other species, more widely spread in their distribution, have more or less distinct varieties or forms peculiar to the whole Tristan group or certain islands of it. Several of the recorded species are quite possibly introduced, as they are more or less cosmopolitan weeds accompanying man wherever he goes. Ferns and mosses grow luxuriantly along the streams and under the waterfalls, and the trees are thickly covered with a growth of lichens. The coast is bordered with the usual fringe of kelp common

FIG. 12.—Gough Island, Landing-place at the Mouth of the Glen. Tussock-grass (*Spartina arundinacea*) and Buckthorn (*Phylica nitida*) on rocks. Water-worn stems of Tree-fern (*Lomaria boryana*) on beach.

to all these southern islands. Further exploration of the island, particularly the higher ground which we were unable to reach, would doubtless reveal several additional species of plants.

Gough Island lies within the region of prevailing westerly winds, and in consequence stormy weather and heavy rains are usual, while near inshore frequent squalls blow off the high lands with great force. Long spells of fine weather appear to be uncommon, but from Comer's meteorological log,[1] October seems to have been the best of the spring and summer months. During the *Scotia's* visit the weather was probably unusually fine and sunny, though mist and showers on land recurred throughout

[1] *The Birds of Gough Island*, etc. G. E. Verrill *loc. cit.*.

the day and the squalls were severe. The number of rainbows was a noticeable feature of the weather.

Mr. Andrews says that during the winter he spent on the island heavy snow and hard frost were common, and Comer records, as mentioned above, how a man was frozen to death in crossing the island in October. During the *Scotia's* visit in April (*i.e.* autumn) the temperature was relatively high, ranging from about 48° to 50° F. While no meteorological data for Gough Island are obtainable, there is every probability of the general weather conditions closely approximating to those of Tristan da Cunha.

Landing at unprotected oceanic islands is generally a matter of difficulty, and Gough Island is no exception, according to all accounts. Comer's vessel lay three weeks off and on before an opportunity to land occurred, and on two days of the *Scotia's* three days' stay off the island landing was out of the question, and on the other we only got ashore with some difficulty and risk.

No doubt, looked at from an impartial standpoint, Gough Island is but a relatively insignificant rock in mid-ocean, but its very isolation makes it of great interest. It may throw light on some former continuity of land in the southern hemisphere, and it cannot fail to elucidate various problems in biological distribution when its fauna and flora have been thoroughly investigated. It is for these reasons that its further exploration is so much to be desired.

THE ANGLO-PORTUGUESE BOUNDARY IN CENTRAL AFRICA.

By S. H. F. Capenny.

(*With Map.*)

The spheres of Great Britain and Portugal in Central Africa were determined generally by treaty in 1891, but the boundary between British Central Africa and Angola remained undefined. By the fourth article of the treaty between the Britannic and Portuguese sovereigns, defining their respective spheres of influence in Africa, which was concluded at Lisbon on the 11th of June 1891, and ratified on the 3rd of July in London, it was agreed that the western line of division separating the British from the Portuguese sphere of influence in Central Africa should follow the centre of the channel of the Upper Zambezi, starting from the Katima Rapids, up to the point where it reaches the territory of the Barotse kingdom. It was agreed that the Barotse territory should remain within the British sphere; and that its limits to the westward, which would constitute the boundary between British and Portuguese spheres of influence, should be decided by a Joint Anglo-Portuguese Commission, which should have power, in case of difference of opinion, to appoint an umpire. It was understood on both sides that nothing agreed upon in this fourth article should affect the existing rights of any other State. Subject to this reservation, Great Britain would not oppose the extension of Portuguese administration outside of the limits of the Barotse country.

This treaty was supplemented, pending the delimitation of the boundary, by an agreement between Great Britain and Portugal relative to spheres of influence north of the Zambezi, recording the terms of a *modus vivendi* negotiated in the early part of 1892. It was agreed, by a formal exchange of Notes between the Earl of Rosebery and

The Anglo-Portuguese Boundary in Central Africa.

M. de Soveral in London on the 31st of May and the 5th of June 1893, that, pending the delimitation of a boundary line as laid down in the fourth article of the treaty of the 11th of June 1891, the line formed by the course of the Zambezi from the cataracts at Katima up to its confluence with the Kabompo river, and thence by the course of the Kabompo, should be the provisional boundary between the respective spheres of influence in that region.

In Article VIII. of the 1891 treaty the two Powers engaged that

neither would interfere with any sphere of influence assigned to the other; that one Power would not, in the sphere of the other, make acquisitions, conclude treaties, or accept sovereign rights or protectorates. And it was agreed in 1893 that these provisions should be applicable to the territories separated by the provisional boundary until a definitive boundary should have been substituted in its stead. The *modus vivendi* should not be held as prejudicing in any way the ultimate territorial rights of Great Britain and Portugal.

Since 1899 Barotseland has been designated North-Western Rhodesia, and its limits for the purposes of administration by the British South Africa Company were defined by the *Barotseland - North - Western Rhodesia Order in Council*, dated 28th of November 1899, as the parts of Africa bounded by the River Zambezi, the German South-West Africa Protectorate, the Portuguese possessions, the Congo Free State, and the Kafukwe (Kafue) or Luengi River. It has been organised into five districts. The western boundary of the British administration was formed by the Zambezi and the Kabompo.

Everything depended, therefore, on what territories to the west of the Zambezi and the Kabompo were to be regarded as Portuguese possessions. If the claims to sovereignty or suzerainty which King Lewanika asserted could be made good, the Barotse territory would extend for hundreds of miles to the north and west of the provisional boundary. In a map of Southern Central Africa, which appeared in this *Magazine*, October 1901, there is shown the western boundary of Barotseland as indicated on the official map issued by the British South Africa Company. In M. Alfred Bertrand's *Au Pays des Ba-Rotsi*, which was published by Hachette, Paris, in 1898, the western boundary of the Royaume des Ba-Rotsi is made to follow the 20th meridian from the Kwito up to the basin of the Lungwebungu, where it bends to the west.

As it was found that no settlement of this boundary question could be effected by negotiation, it was agreed to refer the dispute to an arbitrator, and the King of Italy was chosen by the Anglo-Portuguese Convention of August 12, 1903.

In the middle of June 1905 the King of Italy's award was made known. As the text of the award not only defines the scope of the arbitration, but enunciates the principles followed, it will be best to give it here in full:—

"We, Victor Emmanuel II., by the grace of God and the will of the nation King of Italy, the arbitrator in the question between Great Britain and Portugal regarding the western limits of the territory of the kingdom of Barotse as they were on June 11, 1891, His Majesty Edward VII., King of the United Kingdom of Great Britain and Ireland, Emperor of India, and His Most Faithful Majesty Charles I., King of Portugal and the Algarves, wishing to settle the question which has arisen between the two States relative to the frontier of their respective spheres of influence in Central Africa, have by declaration, signed in London on August 12, 1903, charged us to decide as arbitrator the said question by final award, without appeal:

"We, the King of Italy, being desirous to respond to the confidence that the High Parties have been good enough to bestow on us, have agreed, and we deliver the following award on the question of fact:—

"Great Britain and Portugal, in order to determine their respective spheres of influence in Central Africa, had concluded at Lisbon the Treaty of June 11, 1891, and by Article IV. of said Treaty had agreed to what follows:—

"It is understood that the line which separates to the west the sphere of influence of Great Britain in Central Africa from that of Portugal will follow the centre of the channel of the Upper Zambezi, starting from the Katima Rapids to the point where it touches the territory of the kingdom of the Barotse. The said High Parties having been unable subsequently to agree upon the western limits of the kingdom of Barotse, signed in London on August 12, 1903, the declaration by which they devolved upon us to decide the question which they formulated themselves in the following terms:—

"Article I.—The arbitrator shall be asked to give a decision, which shall be accepted as final by both parties, on the question what are within the meaning of the above-quoted article of the Treaty of 1891 as the limit of the territory of the Barotse kingdom. For purpose of the arbitration the expression 'the territory of the Barotse kingdom' shall mean the territory over which the King of Barotse was the paramount ruler on 11th June 1891.

"The question having been thus formulated, we considered that we were called upon to determine the territory over which the King of the Barotse was the paramount ruler on June 11, 1891. We considered also that since we have to decide the question which has been submitted to us with reference to June 11, 1891, we could not take into account things which have occurred since that date. We subsequently examined attentively the memorials, replies, rejoinders, and documents in support of which each of the High Parties presented to us.

"On the question of right—

"Whereas, tribute cannot, as such, be taken as proof of the authority of the paramount ruler residing in the person to whom the said tribute is paid; in fact a tribe while independent often pays tribute to the chief of another and stronger tribe, either to relieve itself by this means of vexations and avoid war, or to gain his goodwill and protection;

"Whereas, not even the influence exercised by a chief of a stronger tribe over other weaker ones can be considered decisive proof of the independence and actual subjection of the tribes under the said influence;

"Whereas, consequently, to recognise King Lewanika as paramount chief, it is indispensable to ascertain what were the tribes which on June 11, 1891, were in a position of actual dependence in respect to him;

"Whereas, according to the internal organisation of the tribes, the paramount chief is he who exercises governmental authority according to their customs—that is, by appointing subordinate chiefs, by granting them investiture, by settling disputes between those chiefs, by deposing

them if need be, and by forcing them to recognise him as their supreme lord;

"Whereas, such power had without doubt been already exercised by the King of the Barotse in the province of Nalolo, to the west of the Zambezi, exercised also over the tribes of the Mabuenyi and Mamboe, so that their territory formed an integral part of the kingdom of Barotse;

"Whereas, as regards the Balovale, while having paid tribute, they were on June 11, 1891, in a condition of independence, in fact they had their own paramount chief, who named subordinate chiefs without the King of Barotse having up to that time performed any act of jurisdiction or government over the Balovale;

"Whereas, this is confirmed by the testimony of the Rev. Adolf Jalla, who declares that the Balovale refused to submit up to 1891, and were only subjugated by the Barotse at the beginning of 1892 (a fact also mentioned by the Rev. F. Coillard), so that it cannot be admitted that the Balovale formed an integral part of the kingdom of Barotse in June 1891;

"Whereas, however, King Lewanika exercised certain rights of lordship over the frontier zone of his true domains, which is interposed between the Zambezi and the Lungwebungu, and which is inhabited by the Balovale, so that, in view of such rights of lordship, it may be admitted that the said zone formed an integral part of the kingdom of Barotse;

"Whereas, as regards the region of the Malunda, a portion was inhabited by the Balakwakwa, who are ethnically Barotse, and the southern zone had been more directly under the influence of the King of Barotse amounting to actual subjection, so that the territory comprised between the lower course of the Kapombo, the Zambezi, and the thirteenth parallel must be considered an integral part of the kingdom of Barotse, the Bampukush, the Bamashe, the Mambunda, and the Bamakoma, were absolutely independent tribes, and consequently could not be regarded as belonging to the kingdom of the Barotse;

"Whereas, as regards the delimitation of territory over which King Lewanika reigned as paramount ruler, any precise delimitation is impossible, either on account of the want of distinctive geographical elements or on account of imperfect knowledge of localities, or on account of the notorious instability of the tribes and frequent overlappings (circumstances which have been also admitted by the Marquis of Salisbury and the Marquis of Lansdowne), so that it is indispensable where natural lines are wanting to have recourse to conventional geographical lines—

"For the said reasons we decide as arbiter that the Western frontier of the territory of the kingdom of the Barotse on 11th of June 1891 was as follows:—The straight line connecting the rapids of Katima, on the Zambezi, with the Andara village on the Okavango, as far as the point where it meets the Kwando river; the eastern edge of the bed of the upper waters of the Kwando as far as the point of intersection with the twenty-second meridian; the twenty-second meridian as far as the point of intersection with the thirteenth parallel; the thirteenth parallel as far

as the point of intersection with the twenty-fourth meridian; the twenty-fourth meridian as far as the frontier of the Congo Free State."

It will be seen that the principles of this award raise the question of the relation of tribute to the rights of a paramount chief. It has been generally assumed that King Lewanika was recognised as suzerain or overlord by the Valovale (or Balovale), the Chibokwe, the Mambunda, and even by the Baluchazi. When Colonel Harding visited these tribes in 1899-1900, he found that such was the recognised position of Lewanika But the award decides what in the judgment of the arbiter were the limits of the Barotse kingdom to the west and north in June 1891.

The boundary which the award determines has all the disadvantages of an artificial delimitation, and disregards apparently ethnographic considerations. When the boundary is demarcated locally it will be necessary to modify it in its details, in order that limits of tribal territories may be respected.

The experts, who were the King of Italy's advisers in the arbitration, were MM. Fiore and Buzzati, the Professors of International Law, Colonel Perro of the Intelligence Department, and Commandant Bongazli.

It is to be hoped that the papers and maps and other documents will soon be rendered accessible by publication, as they cannot fail to shed considerable light on the geography and ethnography of these little-known parts of Central Africa.

OBITUARY.

Sir Augustus Gregory, 1819-1905.

We regret to record the death of Sir Augustus Gregory, who had had much to do with the exploration of Australia. Sir Augustus Gregory was born in Nottinghamshire in 1819, and emigrated with his father to Western Australia at the age of ten. He subsequently entered the Civil Service of Western Australia, and in 1846 began his long series of exploring journeys with an expedition to the east and north of Swan river, in the course of which some fine seams of coal were discovered at the mouth of the Arrowsmith. Among a number of other expeditions undertaken, perhaps the most important was the North Australian Expedition of 1855-56. On this occasion Gregory, accompanied by his brother and a party of sixteen persons, landed at Victoria river and followed it up to its source, crossed the watershed, and descended a stream flowing south, named Sturt's creek, which ended in a desiccated salt lake. After this the party returned to the Victoria, and thence journeyed to the Gulf of Carpentaria and explored the country lying to the east of the gulf. During this journey the members of the expedition marched 6500 miles through previously unknown country, and in recognition of his work the leader received the Founder's Medal of the Royal Geographical Society of London. Subsequently Gregory was appointed Surveyor-General for Queensland, a post he occupied for twenty years. He also held other posts of distinction under the Queensland Government.

We regret also to record the death of the famous geographer, M. Elisée Reclus, an extended notice of whom will appear in an early issue.

GEOGRAPHICAL NOTES

Europe.

The Distribution of the Population in Sweden.—In *La Géographie* for May 15, M. Charles Rabot has an interesting article on the relation between the distribution of the population in Sweden and the geological characters of the soil, an article based upon various Swedish investigations. The people of Sweden are largely agriculturists, about 50 per cent. being given up to this industry. In consequence the two factors which determine the density of distribution are climate and soil. The first has much less importance than might at first sight be supposed, in view of the fact that there is 10 degrees difference between the mean annual temperatures of the north and south parts of the country. This is due to the fact that there is relatively little difference between the mean temperature of July in north and south, which is the most important month for the agriculturist, the means being 13° C. in the north, and 16° C. in the south. The great factor influencing distribution is then the fertility of the soil, this again being a factor of its geological composition. The two deposits which are specially remarkable for their fertility are the marine alluvial deposits of the Pleistocene period, and the calcareous beds of Silurian age. Generally speaking, therefore, the population becomes dense where these beds appear at the surface. There are two notable exceptions to this statement. The first is the area fronting the Baltic and lying between the mouths of the Angerman Elf and the Ljusne. This region is densely populated—to the north of Sundsvall among the most densely populated areas of the kingdom—and it owes its population not to the fertility of the soil, but to the great development of the wood industry. The other notable exception is to be found in Dalecarlia to the south and south-east of Fahlun, and in the northern part of the department of Orebro. Here the density of population is due to the rich deposits of metals in the subsoil.

It is in Norrland that the relation between density of population and the geological character of the soil is most beautifully shown. Here the population, instead of diminishing towards the north as one would naturally expect, diminishes from east to west, in passing from the coast of the Baltic to the interior. On the littoral the population rises to its maximum of about 10 inhabitants to the square kilometre, while in the interior the density sinks to as low as 1 per square kilometre. This is not due to the development of maritime industries, but to the fact that the soil is only fertile where it consists of marine and estuarine deposits, and the interior region, where the morainic deposits

were not re-deposited by water at the close of the Pleistocene period, is infertile.

In the interior morainic region the density of the population rises wherever the Silurian beds appear at the surface, however rigorous the climate, for here effective agriculture is possible. In consequence in this interior region there are, as it were, densely populated islets, which mark the occurrence of calcareous beds at the surface.

Asia.

The Island of Sakhalin.—An account of this island, which has recently come into prominence owing to its capture by the Japanese, will be found in an article by Mr. Hawes in this *Magazine*, vol. xix. p. 183. In vol. xx. (p. 247) there will also be found a review of Mr. Hawes' book, *The Uttermost East*, which contains a further account of the island, its native inhabitants, and the Russian penal settlements there.

Africa.

Fayûm Flint Implements.—We have received from the author a pamphlet by Mr. H. W. Seton-Karr giving an illustrated account of a very large number of flint implements discovered during an expedition to the Fayûm desert in October 1903. Mr. Seton-Karr finds that the implements do not only occur along the borders of the old lake, but also in any locality where there are no superimposed deposits. Such localities especially occur on the summit of undulations where the prevalent north wind keeps the sand from settling, especially on the north side. In such places the implements are found upon the surface of the sand. There is no doubt that implements of many different epochs have become mixed in the region; but while the author does not definitely assign any of his finds to the Palæolithic period, he is inclined to believe that implements of that period must be represented.

America.

Gorgona Island, Colombia.—In the *Bulletin* of the Museum of Comparative Zoology, Harvard (xlvi. 5), there appears an account of an expedition to this little known island, which lies about twenty miles off Punta las Reys, the nearest point of the Colombian coast. It is uninhabited, and is about five miles long by half a mile wide. The survey party, which was equipped by Mr. John Thayer, hoped to make some interesting discoveries in regard to the vertebrate fauna, but owing to the physical conditions the fauna is singularly poor. The island is apparently of volcanic formation, and consists of three peaks, of which the central peak is 800 feet high, and is the highest. The island is completely wooded, without trails or open places, and is abundantly watered by numerous streams. Rain falls continuously throughout the year, and electric storms are frequent. Owing to the excessive moisture and the dense forest, collecting could only be carried on under great difficulties. At low tide it is possible to walk along the beach, but high

water reaches to the forest line, and then every step inland had to be cut through the jungle by means of machetes. The fauna of the island is extremely poor. Birds are scantily represented alike in number and species, and mammals are only represented by two bats, a monkey, a spiny rat, and an agouti. The monkey and spiny rat belong to new species. Land crabs were very abundant, and were a great nuisance from the collector's point of view. There were also several species of snakes, and two common frogs. Sixteen species of birds were taken, and of these four land forms are described as new. Scanty as the fauna is, therefore, it shows some very marked distinctions from that of the adjacent mainland.

Polar.

Results of the Scottish National Antarctic Expedition.—We have received a reprint from *The Ibis* for April, containing an article by Mr. W. Eagle Clarke on the birds of Gough Island, based on the collections made by the staff of the *Scotia* during their visit to that island. The collection contains forty-five specimens, and proves to be of extreme interest, containing at least two and perhaps three new species. The *Scotia* party, it will be remembered, were the first naturalists who had visited Gough Island. Previously twelve species of birds were known to inhabit the island, but the *Scotia* specimens included nineteen species, of which twelve had not previously been found there, so that the avifauna of the island now stands at twenty-three species. The affinities of the avifauna are with that of the Tristan d'Acunha group, which lies two hundred miles to the north, but these affinities are not close, for the buntings found respectively on Gough and Inaccessible Islands are specifically very distinct.

General.

The South Africa Meeting of the British Association.—It is announced that 385 members have intimated their intention of proceeding to the meeting of the British Association in South Africa, and of these no less than 276 have expressed the desire to visit the Victoria Falls after the close of the meeting. The following draft programme is given for Section E (Geography). President's Address, "The Afforestation of South Africa"; Mr. Yule Oldham, "The Unveiling of the Coasts of Africa" (with lantern views of old maps); Colonel Johnston, "The Ordnance Survey of the United Kingdom"; Dr. H. R. Mill, "A Comparison of the Periodicity of the Meteorological Conditions of London and Cape Town"; Rudmose Brown, "Gough Island"; Captain Creak, "Terrestrial Globes as a Necessary Adjunct to the Teaching of Geography"; J. Lomas, "Excursions as a Means of Teaching Geography" (lantern views); Dr. Scott Keltie, "The Evolution of Africa"; Dr. A. J. Herbertson and P. C. Waite, "A New Rainfall Map of Africa"; J. Bolton, "Boundaries and Areas in Africa"; Tudor Trevor, "The Physical Geography of the Transvaal"; F. S. Watermeyer, "Notes on the Geography of Africa South of the Limpopo";

Major Stevenson Hamilton, "The Game Preserves of the Transvaal"; Douglas Freshfield, "The Sikhim Himalayas and Tibet"; Professor Cordier, a paper on an Asiatic subject.

In addition to these papers there will be a joint meeting with Section C (Geology), when the subject for discussion will be, "The Physical Geography of South Africa," by H. C. Schunke-Holloway. Other papers of geographical interest to be read before Section C are the following:—Professor W. J. Sollas, "The Continent of Africa in relation to the Physical History of the Earth"; A. W. Rogers, "Glacial Periods in South Africa"; Professor A. Penck, "Changes of Climate as shown by the Movements of the Snow-Line and upper Tree-Line since Tertiary Times"; G. W. Lamplugh, "The Victoria Falls"; and a paper on a physiographical subject by Professor W. M. Davis. One of the popular evening lectures also will be on "Mountains: The Highest Himalaya," by Mr. Douglas Freshfield. This address will be delivered at Cape Town.

Honours for the Members of the Charcot Expedition.—It is announced that by a new law brought before the French Chamber of Deputies the Ministres de la Marine, des Colonies, and de l'Instruction Publique are to have powers to decorate with crosses of the Légion d'Honneur explorers who have deserved well of their country. In the preamble to the new law the members of the Charcot Expedition are specially mentioned as being worthy of these decorations.

The Sociological Society.—We have received from this Society a pamphlet containing an address by the Right Hon. James Bryce on the aims and programme of the Sociological Society, together with the First Annual Report and a List of Members of the Society, among which we note a considerable number of persons interested in geography. The leaflet accompanying the pamphlet states that the Society is intended to provide a common meeting-ground for workers of all schools and fields connected with social phenomena, and among these workers the geographer is expressly named. It may therefore not be out of place here to point out that any of our members interested in the work of the Society may obtain further details on application to the Secretary of the Sociological Society, 5 Old Queen Street, Westminster, London, S.W.

The Expedition to the Indian Ocean.—According to a note in *Nature*, Mr. Stanley Gardiner, the leader of the expedition for the exploration of the Indian Ocean between Ceylon and the Seychelles in H.M.S. *Skylark* (cf. this *Magazine*, p. 337), gives the following as the provisional programme of the expedition. The expedition was to leave Colombo on May 8, and was expected to arrive at the Chagos Archipelago about May 20, where it was to continue work till about July 15. Thence it was to go to Mauritius, staying there till about August 15. From Mauritius the *Skylark* is to make her way to the Seychelles, where the period between September 8 and September 15 will be spent. From the Seychelles the various Amirante Islands will be visited, and the return to the Seychelles will be made about October 15.

It is announced that the Prince of Monaco with his yacht the *Princess Alice* has left for the Azores, and proposes to carry on kite-flying and balloon observations in the North-East Trades.

Commercial Geography.

The Commercial Future of Central Africa.—Lord Mountmorres recently addressed the members of the African trade section of the Liverpool Chamber of Commerce on the subject of "The Commercial Future of Central Africa." Lord Mountmorres said he did not believe that the people in this country realised the enormous wealth that there was in Central Africa. Outside the equatorial forest there was practically an illimitable supply of cheap labour, which only needed directing to be of the utmost service, and there were natural waterways navigable for 8000 miles, whilst the trans-continental railway which was to be run diagonally across Africa would do much to open up the country. As to the mineral resources, there was hardly a part in which copper was not found, and there was iron, lead, and zinc, platinum and gold. In fact, they had in this country every mineral necessary for the self-supporting development of a new country. There were also to be found salt and excellent pottery clay, whilst the soil was very rich, and all crops which could be raised in tropical or sub-tropical climates would thrive there. Rice and wheat had been introduced with success, whilst fruits, spices, condiments, and drugs were plentiful. Coffee was largely cultivated, tobacco had been produced in excellent quality, and the question of cotton growing was said by an expert to have been solved. Woods of all kinds were to be found, and could be remuneratively exported if handled on a large scale, while rubber of the finest was to be found in the equatorial forest. Rubber plants had been so largely planted, too, that in ten years' time something like sixty million plants would be ready for cutting, and thereby produce 60,000 tons of rubber per annum, which was equal to the world's consumption. About two million rubber plants were being planted per year.

The Manufacture of Cotton in the Southern United States.—In *Science* for March 24 there is a brief abstract of a paper read by Mr. Raper, of the University of North Carolina, before the American Association for the Advancement of Science in 1904, which contains some suggestive facts and figures in regard to the manufacture of cotton in the region of its production. Mr. Raper, like most observers, considers that slavery checked the industrial advance of the South; but he believes that the revival of the South since its abolition is due to its own inhabitants, and not to the introduction of energy and capital from the North. He believes that statistics support the view that the South is in process of becoming a great manufacturing area, and that the natural advantages are such that the process will be probably rapid The climate is favourable, water-power abundant, and the feeding, housing, and clothing of the operatives is cheap. In 1880 the Southern States had less than 700,000 cotton spindles and about 20,000,000 dollars

invested in cotton factories. Now there are about 8,000,000 spindles, and nearly 200,000,000 dollars invested—a very marked increase in twenty-four years.

Cotton Cultivation in the Leeward Islands.—We take the following extracts from a memorandum on cotton cultivation in the Leeward Islands prepared by the Hon. F. Watts, a member of the Executive Council of the Islands:—"Probably some 2000 acres of land suitable for cotton growing exist in the eastern and southern districts of Antigua. The eastern district consists of low limestone hills with well-drained valleys and flats where cotton grows well. The sugar industry having been abandoned in a considerable part of the district, the land is now largely covered with low scrub. The southern district consists of volcanic soils, and there are considerable tracts capable of growing excellent cotton. Near English Harbour there are upwards of 1000 acres of land suitable for cotton growing. Of this a large proportion is in the hands of the Government, who are willing to sell or let it for this purpose on easy terms. Some 500 acres may also be found in the western district, known as Five Islands. These figures do not exhaust the whole of the land which may ultimately be brought under cotton. It is quite safe to say that some 4000 or 5000 acres now not under sugar cultivation can be found capable of producing good cotton crops. The prospects of the cotton industry in Nevis are most favourable, and there are large tracts of suitable land at present unoccupied. In Montserrat land on which Sea Island cotton may be profitably grown may be estimated at 4000 to 5000 acres."

NEW BOOKS.

EUROPE.

The Geography of Religion in the Highlands. By "A Member of the Royal Scottish Geographical Society." Pp. 29. With Appendices. Edinburgh: R. Grant and Son, 1905.

This little pamphlet, in spite of its title, deals largely with controversial topics outside our range. Its geographical interest, in the strict sense, is the question what light the distribution of religion throws upon the distribution of the different races of which the Scottish nation is made up. The present lamentable dispute in the religious world of Scotland is, as the author points out, largely, though not entirely, a dispute between the Highland and Lowland members of the community. He states that the Highland type of Presbyterianism prevails over an area of 14,842 miles, with 33,138 inhabitants, that is, over an area of about half Scotland, with barely 7½ per cent. of the total population. Of the inhabitants of the area about half (51 per cent.) speak Gaelic. But a careful examination shows that this distribution of religion does not closely correspond to the distribution of races, for the area takes in 25,000 Norsemen of the eastern parishes of Caithness, a number of persons of Teutonic descent in the north-west of Moray, while it excludes considerable parts of the Gaelic-speaking Highlands of history and romance, where other types of religion prevail. Much of the pamphlet before us is devoted to a consideration of the causes of the peculiarities in the distribution of the different

forms of religion in the Highlands, and the author makes a strong appeal for a religious census of Scotland, on geographical as well as on other grounds.

ASIA.

Au Japon et en Extrême-Orient. Par Félicien Challaye. Pp. 270. Paris: Colin, 1905. *Price* 3 *fr.* 50.

A travelling bursar of Paris University, the author spent two years (September 1899 to August 1901) in travelling round the world, and in this volume he gives us his experiences. In his Introduction he summarises the distinction between European civilisation and the "complex civilisations of the yellow races of Asia" by maintaining that the latter do not possess any idea of science or of human equality," and he insists that "European civilisation has essentially this double intellectual and democratic idea." After studying the Japanese, he arrived at the conclusion that Japan has only borrowed from Europe what would make her strong and independent, and that she has no idea of abandoning her ancient customs.

Arriving in Vladivostock from Japan in June 1901, with the object of returning to France by the Trans-Siberian Railway, this distinguished bursar of Paris University met with a rude reception at the hands of the Russian officials. He was placed under police supervision; and he admits having at one time joyfully taken part in meetings of Russian revolutionaries in Berlin. Eventually he was expelled from Vladivostock, although his passport was in perfect order, and he had letters to the Governor of Vladivostock from the Russian Ambassador to Japan. So much, he says, for the "grande alliance Franco-Russe!"

After visiting Annam and Batavia, the author reached India and Ceylon, and remarks, "India never knew peace and religious liberty till she came under British rule. Divided by race, language, and, above all, religion, the Hindoos cannot become a nation because they have no national sentiment." He, however, erroneously states that the Indian Civil Service is closed to natives of India, and that India is taxed three times more heavily than Great Britain. He speaks of the poverty of India, whereas India was never so prosperous as at present. He apparently mingled much with educated but dissatisfied "jeunes Hindous," and believed all they told him about "those detestable officials who oppress India." In Bombay, at a Parsee reception, he says he observed "Jesuit Fathers walking about with, on their arms, young Hindoo girls *décolletées à l'européenne*,"—an extraordinary ecclesiastical sight, if true. He also met a leading Parsee who was so thoroughly a vegetarian that he wore only boots made of india-rubber, and went on foot rather than be drawn by a horse. There is much of interest and amusement in this well-written book.

AFRICA.

In Unknown Africa. By Major P. H. G. Powell-Cotton, F.R.G.S., F.Z.S. Pp. xv + 619. Two Maps, and many Illustrations. London: Hurst and Blackett, Limited, 1904. *Price* 21*s. net.*

The journey here narrated lasted twenty months, and covered a great stretch of territory north of the Uganda Railway and Victoria Nyanza. Starting from Stoney Athi Station, Major Powell-Cotton passed west of Mount Kenia, reached the north side of Mount Elgon, and then struck north-west as if for Gondokoro. But before reaching that post he visited the Albert Nyanza, and thus was enabled to descend the whole length of the main branch of the Nile. His chief purpose, besides exploration, was big-game shooting, and the crack of the rifle is heard con-

tinuously through the book. The result of his trip has been the filling up of several gaps in the Natural History Museum at South Kensington, the discovery of some novel species (a six-horned variety of giraffe now bears the author's name), and an elaborate Appendix of notes on specimens collected. These specimens are being further discussed elsewhere. The notes do not disdain a special class for Lepidoptera, and there is a long list of the local names for animals.

We find many instances in the narrative of the author's intrepid leadership, his equable judgment, and his most useful skill in long shots. Such adventures as that with the elephant on page 52, or with the lion on page 213, the attack by the Dodinga on the camp, or the desperate search for water when trying to make the Tarash Valley, are not what one desires to repeat. Among many items of interest we may mention the cave-dwellers on Mount Elgon, and the burnt-sacrifices of the Elgeyo tribes. The good manners of the elephant, it seems, lead it to bury carefully the body of any man or lion it may have been under the necessity of killing, and when it feels that its own end is approaching it does not lie down in its neighbours' feeding-ground, but removes itself to the appointed place—where elephant bones strew the countryside. While much valuable information is given about the country and its natives, it is to be feared that much of this must become obsolete before Messrs. Cook can hope to bring the region within the sphere of their operations. Major Powell-Cotton's criticisms on the administration of our Protectorates, both with reference to the game-laws and otherwise, are well worth the consideration of the powers that be, and we trust that among them, and among the unofficial public, his book will find many readers.

GENERAL.

Une Année de Politique Extérieure. Par René Moulin. Préface de M. Jules Godin. Paris: Plon-Nourrit et Cie., 1905.

This small volume gives a summary account of the chief political events of the eventful year 1904. In his preface M. Godin laments that in general his countrymen are prone to neglect the study of events occurring outside their own boundaries, and to remain ignorant of even important political changes, whence the necessity for such books as the present. But though primarily intended for French readers, it will also prove of interest to those in this country desirous of knowing how familiar facts look when regarded from another standpoint than the insular. Many of the "political" events recorded have of course considerable, if indirect, geographical significance.

Stanley, le roi des Explorateurs. Par Joseph Joûbert. Angers: Germain and G. Grassin, 1905.

In the fifty odd pages which make up this pamphlet, M. Joseph Joûbert gives a concise and vivid sketch of the life of the great explorer. That the author has a wide knowledge of the history of African exploration is shown by his extensive references to authorities, both British and Continental. Stanley's life, no doubt, lends itself to graphic word-pictures; but M. Joûbert makes good use of his material, and he succeeds in giving to the reader a vivid impression of that combination of qualities and powers which make up Stanley's character. As the title indicates, M. Joûbert is frankly an admirer, but he is not beyond being critical. Few, however, will quarrel with his final estimate of Stanley as one of the most commanding personalities of his epoch, perhaps of all time, worthy in his sphere to be placed beside the greatest names in history.

The fact that this sketch is by a foreigner sometimes adds to the interest. Due credit, for example, is given to the Royal Scottish Geographical Society for instigating, and to Sir William MacKinnon for organising, the Emin Pasha Relief Expedition. But the fact that the English Government contributed towards the expense suggests to M. Joûbert—"la politique à longue vue."

L'Évolution de la Terre et de l'Homme. Par G. Lespagnol. Pp. 720. Paris: Ch. Delagrave, 1905. *Price* 5 *fr.*

This learned and excellent treatise is divided into four Parts :—1st, Exploration of the World, Geographical Science ; 2nd, Mathematical and Physical Geography ; 3rd, Human Geography ; 4th, Leading Features of the Economic Geography of the Globe. It is illustrated by very numerous maps and views, and forms an all-embracing handbook of the geography of the world. In his able chapter on the science of geography the author says, "Geography was born in Greece. The Greeks initiated many of the problems which have agitated human thought. Their spirit of inquiry impelled them to endeavour to understand the phenomena they observed, and, in spite of many errors, they solved some problems, and had true perceptions. The Romans did not possess the same spirit of scientific research, and have only slightly contributed to the progress of geographical science."

After discussing that progress from ancient times onwards, the author considers that it made decisive strides during the nineteenth century, when, he says, "Geography may be said to reach its haven and acquire possession of itself. Everything contributed to that final effort, particularly during the second half of the century. Exploration became definite. Only a few white spaces now remain on the map, and, excepting perhaps in the Polar regions, they do not seem likely to promise us surprises. Expeditions have accumulated a prodigious harvest of geographical facts. Great scientific investigations, and geological, topographical, meteorological, hydrographic, and other surveys have been, under various names, organised in countries of very different character, and observations of every kind have been gathered and studied. Science has made a magnificent advance. Mathematics and Physics, however ancient they may be, have put forth new branches and have increased their sphere of influence. Climatology, the application of Meteorology, dates only from the middle of the century. Oceanography is a quite recent science. Natural Science, born in the eighteenth century, became developed in the nineteenth. Botany and Zoology are to-day mistresses of their methods. Geology is making constant progress, imparting solidity to geographical conclusions by its explanation of the past, which has guided contemporary geographers. Finally, we must not overlook the sciences which devote themselves specially to Man. Anthropology and Ethnography, born in the nineteenth century, have, after some preliminary hesitation, made a real advance. Great services have also been rendered by statisticians who have furnished geographers with valuable communications on natural products, population, commerce, etc. . . . In the light of the new facts abundantly obtained by scientific research, Geography has been definitely purified from errors formerly current, and a rational system of Geography has been created, entitling it to rank among the Sciences. The list of those who have accomplished this is long, but it suffices to recall the work of two grand thinkers who, at the opening of the nineteenth century, possessed the knowledge of what ought to be the science of Geography—Alexander von Humboldt and Karl Ritter. These two men represent the integral conception of Geography. We cannot exaggerate the importance of the impulse which they gave to geographical studies. They were, in the truest sense of the word, pioneers."

La Science Géologique, ses Méthodes, ses Résultats, ses Problèmes, son Histoire. Par L. de Launay, Ingénieur en chef des Mines, Professeur à l'Ecole Supérieure des Mines. Paris : Librairie Armand Colin, 1905.

The author in this work attempts to give a clear account of the methods followed and the results obtained by the modern science of geology in the pursuit of its object, which is broadly defined as the description of the present constitution of the earth, the history of the earth and its structural variations, and the interpretation of this constitution and of this history. It is not, however, a mere text-book of geology, for all lists of fossils, descriptions of formations, and the multitude of facts commonly found in such treatises are omitted. Technical terms are reduced to the smallest number consistent with precision, and they are for the most part clearly explained.

The subject is a vast one, but it is one which, treated in a broad way, cannot fail to be attractive to the growing circle of those who interest themselves in the results of modern science. Indeed, it is to this class that the author more directly appeals.

The book is divided into two parts, the first of which is occupied with an outline of the history and of the methods employed by geologists in all branches of their science.

The second part gives an account of the chief results which bear on general questions, of the views which are commonly held at the present day, and of the problems which await solution. Chapters XI. and XII. are devoted to Tectonics and to Palæo-geography. The history of the earth comprises a certain number of troubled phases characterised by the folding-up of mountain-chains and the depression of blocks of the earth's crust along vertical lines of fault. Alternating with these are periods of calm, when, apparently, slow displacements of the sea alone occur. The periods of disturbance are not rigorously synchronous from one region to another, and may even be conceived to alternate. Nevertheless the regions affected are vast, and the effects can be followed over a whole hemisphere. In studying the cycles of calm and disturbance, the geological phenomena present striking analogies in their grouping and arrangement. There is recurrence, but not identity. Alongside recurrence there is a progressive evolution.

Four principal periods of folding are recognisable, during each of which an important mountain-chain originated in Europe. These chains are termed the Huronian, the Caledonian, the Hercynian, and the Alp-Himalayan. They appeared in pre-Cambrian times, in late Silurian times, during the Carboniferous and during the Tertiary period respectively, and each lay a little to the south of its predecessor. The author has much to say about the Hercynian chain, represented in France by Brittany and the Central Plateau, but the ancient Caledonian chain, which covered most of Ireland and Wales, and extended in a north-easterly direction over Scotland and the north of Scandinavia, receives only scant attention.

The next three chapters discuss Petrography, the science of mineral veins, and the distribution of the chemical elements in the earth. Of the last subject, which is the author's own, he has much to say that is both original and interesting. The following chapter deals with the results of Palæontology, whilst the last one is devoted to cosmological conclusions.

In addition to figures in the text, there is an interesting coloured map showing the different zones of folding in the northern hemisphere, and another one of Europe on a larger scale.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

Twenty Years on Ben Nevis; being a Brief Account of the Life, Work, and Experiences of the Observers at the highest Meteorological Station in the British Islands. By Wm. T. Kilgour. *Crown* 8*vo*. *Price* 2*s*. 6*d*. *net*. Paisley: Alex. Gardner, 1905.

The Calvert Scientific Exploring Expedition, Australia, 1896. Compiled by J. G. Hill. Pp. viii + 44. *Price* 2*s*. London: George Philip and Son, Ltd., 1905.

Coins D'Egypte Ignorés. Par Albert Gayet. Pp. xviii + 306. *Prix* 3 *fr*. 50. Paris: Plon-Nourrit et Cie., 1905.

En Zigzag de Singapore à Moscou, Notes de Route. Par Jean de Nettarcourt-Vaubecourt. Pp. viii + 322. *Prix* 3 *fr*. 50. Paris: Plon-Nourrit et Cie., 1905.

Russia. By Sir Donald Mackenzie Wallace, K.C.I.E., K.C.V.O. In two volumes. New and Enlarged Edition. Revised, Re-set, and in great part Re-written. Large 8vo. Vol. I. pp. 456, Vol. II. pp. 487. *Price* 24*s*. *net*. London: Cassell and Co., Ltd., 1905.

The Faroes and Iceland: Studies in Island Life. By Nelson Annandale. With an Appendix on the Celtic Pony, by F. H. A. Marshall, D.Sc. Crown 8vo. Pp. viii + 239. *Price* 4*s*. 6*d*. *net*. Oxford: The Clarendon Press, 1905.

The World of To-Day: A Survey of the Lands and Peoples of the Globe as seen in Travel and Commerce. By A. R. Hope Moncrieff. Volume ii. Royal 8vo. Pp. vi + 266. *Price* 8*s*. *net*. London: The Gresham Publishing Co., 1905.

Switzerland, and the Adjacent Portions of Italy, Savoy, and Tyrol: Handbook for Travellers. By Karl Baedeker. With 63 Maps, 17 Plans, and 11 Panoramas. Twenty-first edition. Pp. xxxviii + 548. *Price* 8*s*. Leipzig: Karl Baedeker, 1905.

A Guide to Zermatt and the Matterhorn. Pp. xiv + 224. *Price* 3*s*. *net*.

A Guide to Chamonix and the Range of Mont Blanc. Pp. xiv + 206. *Price* 3*s*. *net*. By Edward Whymper. London: John Murray, 1905.

In Remotest Barotseland. By Colonel Colin Harding, C.M.G., F.R.G.S., Acting Administrator of North-West Rhodesia, and Commandant Barotse Native Police. Demy 8vo. Pp. xvi + 414. *Price* 10*s*. 6*d*. *net*. London: Hurst and Blackett, Ltd., 1905.

Canadian Life in Town and Country. By Henry J. Morgan and Lawrence J. Burpee. Crown 8vo. Pp. xii + 267. *Price* 3*s*. 6*d*. *net*. London: George Newnes, Ltd., 1905.

Also the following Reports, etc. :—

The Geology of the Country round Blair Atholl, Pitlochry, and Aberfeldy. (Explanation of Sheet 55.) By G. Barrow, F.G.S., J. S. Grant Wilson, and E. H. Cunningham Craig. With Petrological Chapter and Notes by J. S. Flett, M.A., D.Sc., M.B., C.M. "Memoirs of the Geological Survey." *Price* 3*s*. Edinburgh: Geological Survey Office, 1905.

A Handbook of Cyprus. Compiled by Sir J. T. Hutchinson, M.A., and Claude D. Cobham, C.M.G. Crown 8vo. Pp. xii + 126. *Price* 2*s*. 6*d*. London: Edward Stanford, 1905.

Bibliotheca Geographica herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otta Baschin. Band x. Jahrgang 1901. Berlin: W. H. Kühl, 1904.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

SOME GEOGRAPHICAL PECULIARITIES OF THE INDIAN PENINSULA.

By Cameron Morrison.

Most people have some acquaintance with the difficulties which hamper the development and administration of India, but it is seldom recognised how much these are affected by the physical geography of the country, or rather continent, itself. A great many of the efforts of government are spent in supplementing the work of nature in ways unknown in most other countries. How great the handicap is under which it labours can only be understood by tracing some of the more palpable shortcomings observable in the physical features and conformation of our great Dependency. Some of these would seem fairly obvious.

India, for its extent, has one of the shortest coastlines of any important country bordering the ocean. Its outline is scarcely broken by a single inlet in its 5000 miles of sea-coast, and thus, at the start, it is handicapped by having its inland regions, some of them the most fertile and important, far removed from the sea. The development of India's enormous internal resources has thus been retarded, and we can here discover one of the most potent reasons why India, till comparatively recent times, has been cut off from Western influences. We have only to compare India and Europe, with its indented coasts and narrow seas, the highways of civilising commerce, to recognise the penalty in stagnation and comparative isolation which India has had to pay for her topographical defects.

The great Indo-Gangetic plain, stretching across the continent from the Arabian Sea to the Bay of Bengal, is one of the wealthiest and most fertile regions of the earth's surface. Yet it might well be open to question whether, if the continent were sunk sufficiently to flood the whole of this immense valley (and at no part is it more than 800

feet above sea-level), the gain to India, in thus having a great area of the "unharvested sea" intersecting her land area, would not compensate for the loss of thousands of square miles of cultivated soil. Even the few inlets actually existing are practically useless. Thus on the west coast the Ranns and the Gulf of Cutch, as well as the Gulf of Cambay, appear as if they might be the sheltered roadsteads of a flourishing commerce. But the map does not tell us, what is the fact, that these Ranns, though covering an area of 8000 square miles, are, in the wet season, only some eight feet deep at the most, and that for a great part of the year they are a wilderness of salt sandy marsh, the haunt of wild asses. The Gulf of Cambay, again, is too shallow to allow of the use of it by ocean-going ships. It is silting up, and the once flourishing towns on its shores are gradually being left high and dry even by the small tide of commerce that formerly visited them. The Gulf of Manaar and Palk's Passage, between the mainland and Ceylon, look, on the map, like a second Strait of Dover, a highway of ocean shipping, with sheltered coasts for the rise of trade emporia. But besides being in most parts too shallow for big steamers, this great natural ocean-passage is blocked by islands and a reef of rocks stretching from one shore to the other. The Government of India have, indeed, in view the cutting through of the Pamben Island to admit of vessels of deep draught using the channel, and so saving the many extra miles of the present route round the south of Ceylon, but the engineering difficulties and the expense make the success of any such project precarious in the extreme. The only other part of broken coast is found in the delta of the Ganges, but, on examination, it turns out to be a waste of water-logged sandbanks, with but one opening, the Hugli estuary, practicable for ocean traffic in its long sea-face of 200 miles. Even this is extremely difficult to navigate, and it is only kept serviceable by dredging and constant supervision of its shifting shoals.

Nor has India been any better treated in the way of islands, which in other more favoured regions afford sheltered anchorage for shipping. The islands geographically belonging to India, with the exception of Ceylon, may be neglected, while those connected with it for purposes of administration, such as the Laccadives, Andamans, and Nicobars, lie too far off the coast or too remote from the recognised ocean routes to materially help its commerce. For the most part they are barren coral formations or rocky reefs, the inhospitable abodes of uncivilised aborigines. The islets which protect the entrance to Bombay harbour, and make it the great western emporium of the Indian Empire, serve, by their very uniqueness, to illustrate what might have been had the rest of the coast been similarly favoured.

Further, there are no inland seas to foster internal commerce. The one or two minute patches of blue that appear on some maps turn out to be shallow lakelets which shrivel into salt swamps in the hot season. And the absence of these familiar aids to external and internal commerce is accentuated by the mountain ranges, dividing India from her neighbours, and one part of the country from another. To landward India is hemmed in by a range, or rather by several ranges. On the

north the Himalayas, rising rank behind rank, present an almost impenetrable barrier to Tibet and Russian Turkestan; on the west Baluchistan and Afghanistan are shut off by lower ranges and practically desert uplands; on the east fold after fold of the Himalayan spurs come down to the Bay of Bengal and effectually cut off communication in that direction. For purposes of defence, of course, this mountain conformation is of inestimable value, and the saving effected by concentrating attention on the few vulnerable points in nature's barrier is a consideration not to be lost sight of. Still it is a matter of history that, in the past, these mountains have not saved India from at least five distinct invasions from the highlands of Asia and Persia, and it is a matter of fact that they have practically cut her off from peaceful intercourse with her neighbours. Thus the amount of merchandise sent into, and coming from Tibet during a year, does not equal that carried in one voyage by a single P. and O. liner, and the total trans-frontier trade of India is well under 5 per cent. of that passing through the few ports on the coast. One of the anomalies of the working of our Indian Empire is that the splendid country of Burma is virtually cut off, on the land side, from the contiguous districts of India by the great masses of impenetrable and unexplored mountains stretching from the confines of Upper Assam to the termination of the Arakan Yomas at Cape Negrais.

Again, within the limits of India proper, the two great ranges of the Peninsula, the Vindhyas, which form the northern, and the Ghats, which form its western buttress, have prevented anything but the very gradual Hinduising of the districts within these ranges, and they contain large tracts which still remain the undisturbed hunting-grounds of numerous aboriginal hill tribes. When speaking of the Western Ghats, one can scarcely escape the reflection that by their position so near the windward coast of India they effect a great waste of the rainfall that would otherwise fertilise large tracts of the Deccan, but precariously supplied as things are. The range lies fair in the track of the monsoon, which, in ascending its slopes, is precipitated in torrents of rain and emptied of a very large proportion of its moisture. This rain, however, (over 100 inches in the year on an average) flows, most of it, down the short western slope to the sea, and is practically lost to cultivation, except over a narrow coast strip. The Madras Government, at great expense, have succeeded in damming up one of these west-flowing streams, and, by cutting a tunnel back through the hills, have led it eastwards to irrigate a vast tract on its long journey across the Peninsula to the Bay of Bengal. The immense gain to cultivation resulting from this piece of engineering illustrates, on a small scale, what might have been the case had the Western Ghats, instead of hugging the coast, formed a central divide down the Peninsula, with a great extent of plain sloping to the sea on either flank.

The subject of rainfall leads naturally to that of rivers. Here at least, it may be thought, India is comparatively well off. One can scarcely place a pin-prick on the map that is not within a few miles of some river or tributary as large as the Tay or Thames. For example, right in the south of the Peninsula, opposite Ceylon, there is a stream,

the Tambraparni, which no one out of India, and few out of the district, have ever heard of, which is not marked in ordinary maps, and not named in some large ones, but which, on inquiry, proves to be very nearly as long as the Tyne; and this is only a sample of hundreds of similar cases. Surely a country with so many rivers, three of which rank among the largest in the world, must be peculiarly favoured in respect of waterways, as arteries of cultivation and highways of internal commerce. As a matter of fact, however, there is no respect in which the map of India is so deceptive as in the idea it conveys of the magnitude and importance of the rivers. A short excursion into the main features of Indian hydrography is necessary to make this plain. The river systems of India fall naturally into three divisions:—the Indus and its tributaries in the north-west, the Ganges and Brahmaputra system falling into the head of the Bay of Bengal, and the rivers of the Deccan which drain the slopes of the peninsular plateau from their sources in the Western Ghats eastwards to their debouchment in the bay.

The Indus is longer than the three largest rivers of France placed end to end, and the smallest of its Punjab tributaries is nearly twice as long as the largest river in Great Britain. It has a drainage basin of 372,000 square miles, and a discharge, in the wet weather, of 446,000 cubic feet of water per second. But the benefits it confers on India are not nearly in proportion to these gigantic measurements. Practically one half of its course is spent in inaccessible mountains or sparsely populated valleys. When, after its mountain career, it enters the plains at Peshawur, it has only 1000 feet further to fall, and nearly 1000 miles still to go before reaching the sea. And this part of its course is through the dry belt of the Punjab, where the annual rainfall is but ten inches, and over soft alluvial soil. The same is true, on a smaller scale, of its great tributaries. The consequences are well known. These rivers neither drain nor water the land through which they pass; they are rather great aqueducts from the Himalayas to the sea. The Indus in the dry weather is a perfect network of shallow channels and mud islands, and its tributaries shrivel up into ribands of water in the parched desert. In the wet weather, and when, at the same time, the Himalayan snows are melted, the rivers come down in great floods and quickly cut new channels for themselves in the soft alluvial soil of the plains. This shifting of their banks is a trait not peculiar, indeed, to the Punjab rivers, but in their case it is particularly marked. It is, of course, the cause of great expense to Government, and of anxiety to engineers, who may awake some fine morning to find bridges and revetments left high and dry a mile away from the new bed of the fickle stream. It is no less a frequent source of danger. Colonel Sir Thomas Holdich in his recent work on the geography of India mentions a case where a mere accident prevented a catastrophe. "A loop in the Indus was formed above Dera Ismail Khan some years ago, which, had it straightened itself out, would have cut the station in two. Houses were forsaken or sold for an old song, and it certainly appeared as if the place was doomed. But a tree fell in, up stream, some distance from the city, and the accumulation of drift sand and débris against the fallen tree formed a

natural abutment which shifted the corroding current into a new direction and saved the cantonment."

The result of this little failing on the part of the Indus is seen in the paucity of towns built on its banks. But it is in its third, or delta stage, that the Indus illustrates the wretched fate of so many Indian rivers. While yet nearly 100 miles from the coast it is only some 90 feet above sea-level, and the quantities of silt it brings down have, in course of ages, so raised its bed as to gradually elevate it above the surrounding country. Hence its flood waters easily spill over in different directions, and find channels of their own to carry them seaward. As a means of navigation the Indus is practically lost; its magnificent waterway is split up into scores of insignificant distributaries, and it reaches the sea in a plethora of mudbanks, shoals, and quicksands. Thus a river which could swallow up the Clyde with scarcely an added ripple on its surface can boast of nothing more than a crowd of native craft and a flotilla of flat-bottomed steamers to be displaced on the first appearance of a railway along its banks.

The second river system, that of the Ganges and Brahmaputra, is free, indeed, from some of these drawbacks. For one thing, the course of its factors over the plains is through tracts of well-watered and therefore fertile country. In fact it is precisely the heavier and better-distributed rainfall on the Eastern Himalayas, where the feeders of these rivers rise, that explains the splendid system of irrigation canals of the upper Ganges and Jumna, and the vast network of river navigation over nearly the whole of Bengal, the United Provinces, and up the Assam Valley. But in these provinces a sharp eye has always to be kept on the vagaries of the rivers, which are continually altering their beds on so large a scale that engineers cannot cope with them. There, too, the flatness of the country results in a delta, or rather a triple delta, which effectually frustrates any attempt to bring up ocean-going vessels—except in the single estuary of the Hugli as far as Howrah bridge at Calcutta.

A glance, moreover, at the right bank or Vindhya-fed tributaries of the Ganges shows, even more clearly than in the case of the Indus, the drawbacks of Indian waterways. These tributaries, unlike the others, flow for the most part over narrow, water-worn beds through rocky country subject to sudden storms of rain in the monsoon season. At this period, then, they are subject to great floods which rise rapidly, and as quickly disappear. For example, the Son, one of the largest Gangetic tributaries on this side, is, during the dry weather, a comparatively insignificant stream, but in the monsoon it rises very fast, and the entire rainfall of 21,300 square miles has to find an outlet in its channel. The consequence is that the river swells to one hundred times its normal volume. This sudden rise and fall is characteristic of all the Vindhyan tributaries of the Ganges, which, normally, are of insignificant size. Two conclusions are evident: first, engineers will hesitate to dig irrigation canals through rocky soil to be fed by rivers which quickly run down; and secondly, navigation cannot flourish in rapid currents subject to sudden freshets. For both these purposes

the Vindhyan tributaries of the Ganges, largely as they bulk on the map, are practically of little value.

The rivers of the Deccan afford a further illustration of what has been said. For the most part they flow in deep and narrow valleys across a rocky plateau till they reach the narrow coast-strip on the Bay of Bengal, where the inevitable delta forms. These deep-worn valleys are evidently valueless for irrigation, and it is only in the last stage of their course that anicuts or huge weirs have been constructed, to any large extent, to distribute the life-giving waters over the low-lying tracts: navigation except of a very primitive type is impossible. For example, the Godavari, the length of which is just three times the distance from Edinburgh to London, is, except in a few upland stretches, too fretted with rocks and broken by precipitous falls to allow even of native craft plying on its surface. The same is true in a greater degree of another large river, the Kistna. As for the Kavari, a river fully five times the length of the Clyde, the writer has forded it at Trichinopoly not thigh-deep, a week or two after the rains had ceased. The insignificant traffic on this apparently magnificent waterway is carried on by means of shallow round wicker-baskets of a few inches draught.

As for rivers such as the two Pennars (one of them 360 miles long), and the Palar, it is a common experience during most of the year, when travelling in the districts through which they flow, to be roused by the rumbling of the train over some great viaduct spanning one of their beds, and, on looking out, to find an absolutely dry water-course of bleached boulders and drifted sand. In truth an Indian river, with the exception of the Ganges and the Brahmaputra, and, to a less extent, of the Indus, is rather a natural drain for the flood-waters of the monsoon rains than what is usually suggested by the word in temperate climes. The great evaporation and the circumscribed period of rainfall readily explain this. And the difference between the treatment of a river in this country and in India illustrates the contrast in climatic conditions. Here every effort is made to give our rivers free course to enable them to carry off the drainage from the land. In India, the agriculturist on a small scale, and the Government in magnificent engineering works, seek by anicuts and canals to delay the passage of surplus water as long as possible, and to spread it over as large an extent of irrigated land as they can. These efforts must, however, be confined to certain short seasons, for it cannot be too clearly recognised that, in extraordinary years when the rains fail, and in ordinary years after they have stopped, most Indian rivers are but runnels of sluggish water creeping through the sand.

Lastly, there is a feature of Indian physical geography which may not be familiar to many. The strong currents bearing northwards along the coasts catch up the silt brought down by the rivers and spread it along the shore. The result is a belt of shoal water lying all round the coast which in most places compels vessels of any but moderate burden to anchor a mile or more out to sea. The same process is constantly forming bars across the mouths of rivers which might otherwise be available for the entrance of decent-sized ships, but which, in the dry season, have

not "scour" enough to keep a deep passage clear. Thus, from Bombay on the west coast to Calcutta, there is not more than one natural harbour, and even Madras, which has spent lacs and lacs on its concrete breakwaters, has the greatest difficulty in keeping the fairway clear. In particular, it is difficult to estimate the loss to India caused by the absence of a harbour on the southern coast, available in all weathers, which, like Colombo, the Clapham Junction of the Indian Ocean, might be the half-way house between East and West.

THE FRENCH ANTARCTIC EXPEDITION.[1]

(With Map.)

Dr. Jean Charcot, the leader of the recent expedition to the Antarctic, communicates to *La Géographie* for June 15, a preliminary account of his results. Dr. Charcot also read a paper before the Royal Geographical Society of London, on June 26. The following preliminary account of his results is based on these two sources.

Dr. Charcot states in the first place that owing to lukewarm support in France and the need for haste in fitting out the expedition, he determined to limit his task to the exploration of a narrow corner, the general programme being to survey the north-west coast of the Palmer Archipelago (Hoseason, Liège, Brabant, and the Antwerp Islands); to study the south-west entrance to the Gerlache Strait, wintering as far south as was practicable, to make excursions in spring, and in summer to continue the exploration of Graham Land, with a view to elucidating the question of Bismarck Strait, and to follow the coast as far as Alexander I. Land; in a word, to continue the labours of the Gerlache and Nordenskjöld expeditions. His vessel, the *Français*, 245 tons, was built at St. Malo, and was soon proved to possess a defective engine. The staff consisted of six unpaid officers, and a crew of fourteen, all French except one Italian, an Alpine guide. Dr. Charcot himself was captain, doctor, and also had charge of the bacteriological studies.

The vessel left Havre in August 1903, and Buenos Aires on December 23, 1903. On February 1, 1904, Smith Island, in the South Shetlands, was reached, whence the members of the expedition continued the voyage to Low Island.

Coasting the north-west side of the Palmer Archipelago, they entered Biscoe Bay, and afterwards lay up for eleven days in Flanders Bay. Then, after erecting a cairn on Wiencke Island (this cairn was missed by the Argentine relief expedition, which therefore believed and reported that the *Français* and her crew were lost), they sailed on and reached Pitt Island on February 26, but were compelled by ice to return to Wandel Island. At Wandel Island a well sheltered cove was found, named Port Carthage by the party, on account of its resemblance to the ancient city. Here they wintered, protecting their

[1] The map accompanying this article is reproduced from the June number of *La Géographie* by kind permission of MM. Masson et Cie., Paris.

ship from ice brought in by the north-east gales with cables across the mouth of the narrow haven, erecting a portable house, excavating store-houses, and setting up shelters and instruments for magnetic observation, observation with quadrant and sextant, and so forth. The temperature varied much and suddenly; the lowest was −30·4 F., but a rise from −22° F. to +26·6 F. in a few hours was not uncommon, and was always followed by violent gales from the north-east, which broke up the ice between Wandel and Hovgaard Islands, and so prevented any move being made, in spite of many efforts.

With the return of the Antarctic spring in November and December 1904, a boat excursion, under Dr. Charcot himself, was absent from the ship about twenty days, and reached an island south of Cape Tuxen, about a quarter of a degree south of the winter quarters. The party consisted of five men in addition to the leader. Progress, as may be judged from the distance covered, was found to be a matter of extreme difficulty, the boat having sometimes to be used as a sledge. Good results were, however, obtained during the course of the journey.

At the end of December a channel was made by means of melanite and saws and picks, and the *Français* returned to Wiencke Island. Journeying southwards the party came in sight of the Biscoe Islands, and on January 11 saw Alexander I. Land rising very high on the south-east. The voyage was continued with great difficulty and danger in the hope of finding means to reach the land, on which several peaks hitherto unknown had already been descried. On the 14th the *Français* struck a submerged rock and received damage which necessitated pumping incessantly day and night, and this was maintained for weeks until the ship so far recovered as to be safe with only 15 hours' pumping, in which condition she ultimately returned to Buenos Aires. The new coast along which she was sailing was surveyed, drawn, and named after President Loubet, and the *Français* turned north again past the Biscoe Islands, the expedition completing its survey as it went, and finally reaching Puerto Madryn on March 4.

It will be remembered that in the first account of the results of the expedition [*cf.* this *Magazine*, p. 217], it was stated that the problem of Bismarck Strait had been solved as the result of an expedition through it, but it would appear from Dr. Charcot's fuller account that in the position of Bismarck "Strait" there exists a bay which does not run through to the east coast of Graham Land, as has been supposed, but is a mere inlet.

As regards the details of the work accomplished, from the brief summary which appears in *La Géographie* we extract the following. The region round the winter station has been surveyed by triangulation. The outer coast-line of the islands of the Palmer Archipelago has been surveyed, and the work of the expedition links up with that of the *Belgica* party, and so completes the survey of this region. Further, the Biscoe Islands and parts of the coast of Graham Land have been surveyed, and astronomical observations have been made of various points on Alexander I. Land, which was surveyed from a great distance. These results are indicated upon the accompanying map.

Further, the tides were studied during a period of six months, and the rise proves to be slight, the maximum being about 5 feet. Observa-

Region explored by the French Antarctic Expedition. The shaded parts of the coast-line have been surveyed by the expedition.

tions on the salinity and density of sea-water and on gravity were also made at the winter station.

The meteorological or magnetic observations are also numerous. In regard to biology, observations were made on cetaceans, seals and birds, and of the two latter specimens were obtained. About fifteen species of fish were obtained, together with numerous specimens of marine invertebrates. Some species of mites constitute almost the only animals found living exclusively on the soil of the Antarctic area, and in addition a certain number of parasitic mites were collected. As regards plants, the specimens obtained are chiefly marine algæ, but some mosses, lichens and fresh water algæ were also found.

A considerable number of geological observations were made, and a number of rock specimens collected. Numerous observations were also made and photographs taken of glacial phenomena, notably of the glaciers of Danco Land and the Palmer Archipelago, and of the icebergs encountered.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.[1]

Under the Direction of Sir John Murray, K.C.B., F.R.S., D.Sc., etc., and Laurence Pullar, F.R.S.E.

Part VIII.—The Lochs of the Conon Basin.

In this paper it is proposed to deal with the lochs draining into the Cromarty Firth, which were surveyed by the staff of the Lake Survey, viz. Lochs Crann, a' Chroisg, Gown, Achanalt, a' Chuilinn, Fannich, Luichart, Beannachan, Achilty, Garve, Kinellan, Ussie, Glass, and Morie. The majority of these lochs drain by the river Conon into the head of the Cromarty Firth, while Lochs Glass and Morie drain by independent streams, which fall into the Cromarty Firth on its north-western shore. It has been found convenient, also, to include in this paper a description of Loch Eye, situated between Cromarty Firth and Dornoch Firth. The drainage area under consideration extends from the mouth of the Cromarty Firth on the east to the heights of Carn Breac and An Groban on the west, Carn Chuinneag on the north, and Sgorr a' Choir-Ghlais on the south. The total area, as measured by the planimeter on the 1-inch Ordnance Survey maps, is over 770 square miles, and of this total 336 square miles (or one-half) drain into the lochs now to be dealt with.

The headwaters of the basin take their rise on the flanks of Carn Breac, flowing by various streams into Loch na Moine Moire and Loch an t-Sior (which were not sounded), thence into Loch Crann and Loch a' Chroisg, the outflow from which is carried by the river Bran into Loch Achanalt and Loch a' Chuilinn, and thence into Loch Luichart. Shortly after leaving Loch a' Chroisg the river Bran receives the outflow from Loch Gown, which is fed by the Allt Gharagain, taking its rise on the flanks of Moruisg (3026 feet); and shortly before entering Loch Luichart the river Bran is joined by the river Fannich bearing the

[1] Abstract of a paper which appears in full in the *Geographical Journal* for July.

outflow from Loch Fannich, which is fed by various streams draining the flanks of a grand series of mountains exceeding 3000 feet in height. After the junction of the Bran and the Fannich the river receives the name of Conon, and shortly after leaving Loch Luichart it is joined by the river Meig, bearing the outflow from Loch Beannachan, and taking its rise among lofty mountains culminating in Sgurr a' Chaoruinn (3452 feet). Still further on the river Conon is joined by the Black Water, bearing the outflow from Lochs Garve and Achilty, and taking its rise far to the north on the flanks of Beinn Dearg (3547 feet.) Still further on the river Conon is joined by the river Orrin, and finally falls into the head of the Cromarty Firth at Dingwall. The river Glass, which in its course flows through Loch Glass, rises on the flanks of Beinn nan Eun, and empties itself in the Cromarty Firth at Balconie Point. The river Alness, which flows through Loch Morie, rises on the flanks of Beinn a' Chaisteil, and falls into the Cromarty Firth at Alness Point.

The geology of the district is dealt with by Drs. Peach and Horne, whose notes are appended to this paper, as well as a few biological notes by Mr. James Murray.

Loch Crann.—Loch Crann is a small shallow loch situated a short distance to the west of Loch a' Chroisg, and lying at a slightly higher level. Its striking characteristic is the large area of hilly country draining into it—an area nearly six hundred times greater than that of the loch. It is roughly quadrangular in outline, with a maximum diameter of less than a quarter of a mile, and it covers an area of about 13½ acres, 80 per cent. of which is under less than 10 feet of water. The deeper soundings were taken in the southern half of the loch, the maximum depth observed being 17 feet. The volume of water is estimated at 4 million cubic feet, and the mean depth at nearly 7 feet. Loch Crann was surveyed on August 19, 1902, when the level was determined as being 513·7 feet above the sea. The temperature of the surface water at 5 P.M. on that date was 59·6° Fahr., and at a depth of 14 feet 56·2°.

Loch a' Chroisg.—Loch a' Chroisg (or Loch Rosque) is one of the larger and more important lochs within the basin, lying amid beautiful scenery, the hills on both sides rising to heights exceeding 1500 feet, and culminating in Meall a' Chaoruinn (2313 feet) on the northern shore. It is a good trout loch, and char also occur, but the fishing is strictly preserved. The loch trends almost due east and west, though it is very slightly sinuous in outline; the shore-line is on the whole very regular, except that two conspicuous alluvial cones have been laid down on the northern shore at the mouths of the Allt Duchairidh and neighbouring stream. The loch is 3½ miles in length, with a maximum breadth of nearly half a mile, the mean breadth being over a quarter of a mile. Its waters cover an area of about 640 acres (1 square mile), and it drains directly an area of over 7½ square miles, but as it receives the outflow from Loch Crann its total drainage area is over 19 square miles. The maximum depth of 168 feet was observed approximately near the centre of the loch, opposite the mouth of the Allt Duchairidh entering the loch

on its northern shore, and about 2 miles from the east end. The volume of water contained in the loch is estimated at 2057 million cubic feet, and the mean depth at nearly 74 feet. The loch was surveyed on July 30 to August 1, 1902, and the elevation of the lake-surface, on commencing the survey, was found by levelling from bench-mark to be 508·4 feet above the level of the sea; when levelled by the Ordnance Survey officers on July 3, 1868, the elevation was 507·9 feet above sea-level.

Loch a' Chroisg forms a simple basin with no pronounced irregularities of the lake-floor, the contour-lines enclose continuous areas following approximately the outline of the loch. The 100-feet basin exceeds 2 miles, and the 50-feet basin is nearly $2\frac{3}{4}$ miles, in length, approaching in each case rather nearer to the east than to the west end of the loch, while the small 150-feet basin lies nearer to the west than to the east end. The slightly larger area between 100 and 150 feet than between 50 and 100 feet indicates the flat-bottomed character of the deeper part of the loch, and the soundings show in certain places rather steep slopes both off the northern and southern shores.

Temperature Observations.—The series of observations taken in 1901 by Mr. Clark shows a range of surface to bottom amounting to 10·7°, whereas the two series taken in 1902 show a range of only 5° in each case, and an extreme range of 6°. The upper layers of water down to a depth of 60 feet were much warmer in 1901 than in 1902, but between 60 and 100 feet the 1901 observations indicated a fall of 9° (viz. a fall of 5·7° between 60 and 80 feet, and a fall of 3·4° between 80 and 100 feet), so that the temperature of the bottom layers of water beyond 100 feet was lower in 1901 than was observed at these depths in 1902.

Seiche.—On August 19, 1902, between 4.30 and 5.30 P.M., a seiche was observed by Mr. James Murray within the shelter of the pier at the east end of Loch a' Chroisg, a light west breeze blowing at the time. The amplitude was a quarter of an inch, and the period about $11\frac{1}{2}$ minutes.

Loch Gown.—Loch Gown (or Ledgowan) lies about a mile to the south-east of Loch a' Chroisg, and is also a good trout loch, but the fishing is preserved. It trends in a north-east and south-west direction, is very irregular in outline, and about $1\frac{1}{4}$ miles in length. Though it may at one time have formed a single lake, it is now divided into two distinct lakes having, at the time of the survey, a difference in level exceeding 2 feet. This separation has probably been brought about mainly by the deposition of material laid down by the Allt Mhàrtuin, and the passage between the two is obstructed by weeds, so that it is impossible to row a boat from one loch to the other, except after heavy floods. The two lochs are nearly equal in superficial area, but the southern basin is much deeper than the northern one.

South Loch Gown.—The southern loch is roughly quadrangular in outline, over half a mile in length, and nearly a third of a mile in maximum width, covering an area of about 55 acres, while it drains an area exceeding 13 square miles. The maximum depth of 52 feet was observed relatively close to the north-eastern shore. The volume of water is estimated at 38 million cubic feet, and the mean depth at nearly 16 feet.

The loch forms a simple basin, the 10-feet contour following approximately the outline of the loch and extending a short distance into the passage leading to the northern loch, and the 25-feet basin is centrally placed. Of the entire lake-floor only 13 per cent. is covered by more than 25 feet of water. It was surveyed on August 2, 1902, when the elevation was determined as being 524·4 feet above the level of the sea.

North Loch Gown.—The northern loch is more oblong in outline than the southern loch, so that while nearly equal in length its maximum width is less, viz. about a fifth of a mile. Its waters cover an area of about 48 acres, and it drains directly an area of about 1 square mile; but since it receives the outflow from the southern loch, its total drainage area is over 14 square miles—nearly 200 times greater than the area of the loch. The greatest depth observed was 17 feet, approximately near the centre of the loch. The volume of water is estimated at 14 million cubic feet, and the mean depth at nearly 7 feet. A constriction in the outline towards the southern end of the loch is accompanied by a slight shoaling of the bottom, the result being that a small 10-feet basin near the southern end, with a maximum depth of 13 feet, is separated from the large main basin. Of the entire lake-floor 22 per cent. is covered by more than 10 feet of water. It was surveyed on the same day as the southern loch (August 2, 1902), and the elevation was determined as being 522·1 feet above sea-level.

Temperature Observations.—Serial temperatures were taken in the deepest part of each loch. In the shallow north loch the temperature was found to be constant from surface to bottom, and in the south loch the temperature was constant from the surface down to a depth of 20 feet (though more than half a degree lower than in the north loch); between 20 and 30 feet the fall was 1·2°, and between 30 and 40 feet 1·7°—a fall of nearly 3° in the 20 feet of depth.

Loch Achanalt.—Loch Achanalt is an irregular, shallow loch apparently in process of being silted up, the material brought down by the river Bran forming two long spits extending out towards the centre of the loch. The northern spit extends nearly across the loch, joining the islands, and leaving only a narrow passage close to the eastern shore, through which there was a strong current, and thus practically cutting the loch into two portions. The western shores are bordered by weeds. The loch flows into Loch a' Chuilinn by a short and rapid stream, the difference in level exceeding 4 feet; the Highland Railway is carried over the passage between the two lochs. Loch Achanalt is approximately quadrangular in outline, its maximum diameter exceeding three-quarters of a mile, and it covers an area of about 160 acres, or one-quarter of a square mile. The deepest water was found comparatively close to the western shore, south of the entrance of the river Bran, where two soundings of 9 feet and two soundings of 8 feet were recorded. The volume of water is estimated at 31 million cubic feet, and the mean depth at 4½ feet—half the maximum depth. The area draining directly into Loch Achanalt is very large, exceeding 39 square miles; but since it receives the outflow from Lochs a' Chroisg and Gown, its total drainage area

exceeds 72½ square miles, or 290 times the area of the loch. Loch Achanalt was surveyed on August 9, 1902, when the elevation of the lake-surface was found to be 365·1 feet above the sea; when levelled by the Ordnance Survey officers on May 9, 1870, the elevation was 364·7 feet above sea-level. The temperature of the surface water on the date of the survey was 57·1 Fahr.; the temperature of the river Bran being 55·2 , and of the air 50·8 . On August 19, 1901, Mr. Clark observed a temperature of 60·1° at the surface, and a temperature of 60·4° at a depth of 5 feet.

Loch a' Chuilinn.—Loch a' Chuilinn (or Culen) trends east and west, is irregular in outline, of varying width, and with an undulating floor. It is 1⅓ miles in length, with a maximum breadth of one-third of a mile. Its waters cover an area of about 113 acres, and it drains directly an area of nearly 1¾ square miles; but as it receives the outflow from Loch Achanalt, its total drainage area is over 74 square miles—over four hundred times the area of the loch. The maximum depth of 43 feet was observed approximately near the middle of the loch. The volume of water is estimated at 50 million cubic feet, and the mean depth at 10¼ feet. The bottom of Loch a' Chuilinn is most irregular; close to the west end is a 10-feet basin, with a maximum depth of 29 feet, the slopes of which are in places steep, depths of 20 and 21 feet having been found close in-shore. Separated from this western basin by an interval of about 600 yards, in which the depth does not exceed 8 feet, lies the central 10-feet basin, enclosing the maximum depth of the loch (43 feet), and here again the slope is steep, one sounding of 29 feet being recorded close to the southern shore. Separated from this central basin by a short interval, 7 feet in depth, is a small eastern basin, with a maximum depth of 29 feet; and after another shallow interval the water deepens at the exit of the outflowing river, where soundings of 13 feet were taken. Of the entire lake-floor, 75 acres (or 67 per cent.) are covered by less than 10 feet of water, and 7 acres (or 6 per cent.) by more than 25 feet of water. The loch was surveyed on August 11, 1902, when the elevation of the lake-surface was found to be 360·8 feet above the sea.

Loch Fannich.—Loch Fannich is the largest within the Cromarty Firth drainage basin, and is surpassed in depth only by Loch Glass. It is situated in Fannich deer-forest amid splendid scenery, the mountains along the northern shore rising to heights exceeding 3000 feet, including An Coileachan (3015 feet), Meallan Rairigidh (3109), Sgùrr Mòr (3637), Sgùrr nan Clach Geala (3500), Sgùrr Breac (3000), and A'Chailleach (3276). The trout-fishing is good, the fish being of fair size, but the loch is strictly preserved. The general trend of the loch is east and west, but the two ends have a tendency to bend slightly to the northwards. Loch Fannich is nearly 7 miles in length, the maximum breadth exceeding three-quarters of a mile, and the mean breadth is over half a mile. Its waters cover an area of 2300 acres (or over 3½ square miles), and it drains an area ten times greater (over 35½ square miles). The maximum depth of 282 feet was observed about 1¼ miles from the east

end, and about 5½ miles from the west end. The volume of water is estimated at 10,920 millions of cubic feet, and the mean depth at nearly 109 feet. Loch Fannich forms a simple basin, all the contour-lines enclosing continuous areas, though the deepest part (exceeding 200 feet in depth) lies in the eastern half of the loch. The 50-feet area extends from end to end, coinciding approximately with the outline of the loch. The 100-feet area approaches to within half a mile from both ends, and is nearly 6 miles in length; there is a slight shoaling of the water opposite Rudha Mór to 103 feet, with deeper water to the east and west. The 150-feet area is distant over 2½ miles from the west end, and is over 3½ miles in length. The 200-feet area is 2½ miles, and the 250-feet area 1¾ miles, in length, and they approach to within three-quarters of a mile from the east end. The slight shoaling opposite Rudha Mór has already been referred to, and a similar shoaling is observable within the 200-feet contour opposite Fannich Lodge, where the depth decreases from 226 feet to 212 feet, and increases again on proceeding eastwards into the 250-feet area. A sinuosity is also seen in the 200-feet contour off the southern shore, opposite Fannich Lodge, due to the shoaling of the water from 202 feet to 191 feet, but on the whole the lake-floor may be said to be extremely regular in conformation.

The regularity of the average slope of the bottom is indicated by the gradually decreasing areas between the contour-lines, and the comparatively large area within the deepest contour indicates the flat-bottomed character of the deeper part of the loch.

Loch Fannich was surveyed on August 13 and 14, 1902, and the elevation of the lake-surface was found, on commencing the survey, to be 821·9 feet above sea-level, which is identical with the level observed by the Ordnance Survey on May 27, 1870.

Temperature Observations.—The temperature of the surface water during the two days spent on the survey varied from 52·7 Fahr. to 58·1 (the air-temperature during the same period varying from 51·8 to 57·9).

Loch Luichart.—Loch Luichart is another large and important loch within the Cromarty Firth drainage basin, second as regards length only to Loch Fannich, though slightly inferior as regards superficial area to Loch Glass. It is a good fishing loch situated amid grand scenery, where Strath Bran bends to the south-east to join Strath Conon. Its general trend is north-west and south-east, bending round the base of Sgurr Mairc-suidhe, and it is broadest at the north-west end, narrowing towards the south-east. It is 5 miles in length, with a maximum width of nearly a mile, the mean width being one-third of a mile. Its waters cover an area of about 1130 acres, or 1¾ square miles, and it drains directly an area of about 39½ square miles, but since it receives the outflow from all the lochs described in the preceding pages, its total drainage area is very large—about 149½ square miles, an area eighty-five times greater than the area of the loch. The maximum depth of 164 feet was observed about 1½ miles, or about one-third of the length of the loch, from the north-west end. The volume of water

is estimated at 3288 millions of cubic feet, and the mean depth at nearly 67 feet. The loch was surveyed on August 16, 1902, when the elevation of the lake-surface was found to be 249·8 feet above the sea.

The floor of Loch Luichart is irregular, there being three 50-feet basins separated by shallower water. The largest and deepest lies in the wider north-western half of the loch, and is about $2\frac{1}{4}$ miles in length, approaching to within less than 200 yards from that end. The central 50-feet basin is separated from the north-western basin by an interval of half a mile, in which lies the single small island in the loch, and where the depth in the centre at another place is only 5 feet, and is over $1\frac{1}{4}$ miles in length. Immediately to the south-east of this central basin there is a narrow constriction in the outline of the loch, in which a depth of 16 feet was recorded, succeeded by a slight expansion containing the third 50-feet basin, with a maximum depth of 55 feet and of small extent. The principal 100-feet basin in the north-western part of the loch is nearly two miles in length, and encloses the deepest part of the loch. Two small subsidiary 100-feet basins lie within the central 50-feet basin: one based upon an isolated sounding of 100 feet, the other near the south-eastern end having a maximum depth of 115 feet. The 150-feet basin is nearly a mile in length, and is distant three-quarters of a mile from the north-west end of the loch; the maximum depth of 164 feet was recorded near the south-eastern end of the basin.

Temperature Observations.—Observations were taken on August 25, 1901, by Mr. Clark, and on August 16, 1902, by the Lake Survey. The range of temperature shown by the 1901 observations amounts to 10°, while that shown by the 1902 observations amounts to 8°. The temperature of the upper 60 feet of water was higher in 1901 than was observed in 1902, as was also the case at a depth of 100 feet, but a lower reading was recorded at 80 feet in 1901 than at 70 and 75 feet in 1902.

Loch Beannachan.—Loch Beannachan (or Bennachran) is situated at the head of Strath Conon, amid wild moorland scenery. It trends in a west-north-west and east-south-east direction, narrowing towards the eastern end. It is over $1\frac{3}{4}$ miles in length, with a maximum breadth of one-third of a mile, the mean breadth being a quarter of a mile. Its waters cover an area of 267 acres, or nearly half a square mile, and it drains an area seventy-two times greater—an area exceeding 30 square miles. The maximum depth of 176 feet was observed approximately near the centre of the loch. The volume of water is estimated at 819 million cubic feet, and the mean depth at $70\frac{1}{2}$ feet. The loch was surveyed on August 22, 1902, when the elevation of the lake-surface was found to be 465·6 feet above sea-level; when visited by the officers of the Ordnance Survey on June 6, 1870, the elevation was 465·1 feet above the sea.

Loch Beannachan forms a simple basin, the contour-lines following approximately the outline of the loch, but approaching in each case nearer to the western than to the eastern end. There is a large wooded island at the entrance of the inflowing river at the west end, and a small

island near the exit of the outflowing river at the opposite end. The slope off-shore is in some places very steep, especially at certain points along the southern shore, and at the position of the deepest sounding the slope is steeper off the southern than off the northern shore.

Temperature Observations.—A series of temperatures taken in the deepest part of the loch at 4.15 P.M. on August 22, 1902, shows a range of temperature from surface to bottom amounting to 9° Fahr. The upper 20 feet of water was practically of uniform temperature, followed by a fall of 1·8° between 20 and 30 feet, but the greatest fall observed was one of 3·6° between 60 and 75 feet.

Loch Achilty.—Loch Achilty is a small but deep loch in Torrachilty Wood, near Strathpeffer, containing char. In outline it is somewhat elliptical, with the long axis trending north-east and south-west. It is about 1500 yards in length, by 700 yards in maximum breadth, the mean breadth being 450 yards. Its waters cover an area of about 147 acres (or nearly a quarter of a square mile), and it drains an area exceeding 2 square miles. The maximum depth of 119 feet was observed about 250 yards from the western shore. The volume of water is estimated at 332 million cubic feet, and the mean depth at 51¾ feet. The floor of Loch Achilty is irregular. The 10-feet contour follows approximately the outline of the loch, in many places approaching very close to the shore, but the deeper contours are all sinuous in character, and there are two small basins exceeding 100 feet in depth, the larger and deeper towards the western shore, and the smaller, based on a sounding of 112 feet, near the centre of the loch. Deep soundings were recorded in some positions near shore, while in other positions comparatively shallow soundings were taken some distance off shore. The loch was surveyed on August 20 and 21, 1902, when the elevation of the lake-surface was found to be 98·5 feet above the sea, so that the 100-feet contours show approximately the two small portions of the lake floor which lie below the level of the sea.

Temperature Observations.—Three series of temperatures were taken in Loch Achilty by Mr. Clark in 1901, and one in 1902 at the time of the survey. These serials indicate a most remarkable range of temperature —a range amounting to 21·2° from the surface to a depth of 70 feet on August 11, 1901, and 19·1° from the surface to a depth of 60 feet on August 23, 1901; the range observed in 1902 was much less, viz. 13·5° from the surface to a depth of 100 feet. Down to a depth of 25 feet the readings were higher in 1901 than in 1902, but beyond that depth the temperature was lower in 1901 than in 1902. The greatest fall of temperature was observed between the depths of 25 and 40 feet in both seasons, but the decrease of temperature within this interval of 15 feet amounted in 1901 to 13·3° and 13·4°, while in 1902 it amounted only to 8°. The only observations that may be compared, as regards range of temperature, with these in Loch Achilty, were taken in Loch Monzievaird[1] in the Tay basin on June 8, 1903, when the range amounted

[1] See *Scottish Geographical Magazine*, vol. xx. p. 27, January 1904.

to 20·6° from the surface to a depth of 36 feet, and when a fall of temperature equal to 1·5° per foot of depth was observed between 5 and 15 feet. The temperature conditions observed in Loch Achilty (as well as in Loch Monzievaird) may probably be ascribed to (1) the comparatively great depth; (2) the comparatively small drainage area; and (3) the sheltered position, the thickly-wooded shores tending to temper the force of the winds blowing across the surface of the water. Mention may here be made also of the large range of temperature observed in the little Loch Dubh [1] in the nan Uamh basin on July 12, 1902, when the range amounted to 15½° from the surface to a depth of 100 feet; it is possible that under favourable weather conditions, and later in the season, the range of temperature in the waters of Loch Dubh may equal that observed in Loch Achilty.

Loch Garve.—Loch Garve lies about 5 miles to the west of Strathpeffer, and to the south-west of the mighty Ben Wyvis (3295 feet). It receives the drainage from a large tract of mountainous country lying to the north and north-west. The body of the loch trends in a north-west and south-east direction, and is somewhat elliptical in outline, while the south-eastern end takes a slight bend to the north-east. The loch is over 1½ miles in extreme length, with a maximum breadth of half a mile, the mean breadth being over one-third of a mile. Its waters cover an area of about 380 acres, or over half a square mile, and it drains an area of 114 square miles—an area nearly two hundred times greater than that of the loch. The maximum depth of 105 feet was observed near the centre of the loch, but towards the south-western shore. The volume of water is estimated at 721 million cubic feet, and the mean depth at 43½ feet. The loch forms on the whole a simple basin, with a slight shoaling at the position of the bend in the outline of the loch. The 10-feet and 25-feet contours extend from end to end of the loch, following approximately the form of the shore-line; but the deeper contours are confined to the wide body of the loch, the 50-feet basin being nearly a mile, and the 100-feet basin nearly a quarter of a mile, in length. Off the central portions of both the north-eastern and south-western shores the slope is moderately steep.

Temperature Observations.—Observations were made in Loch Garve in 1901 by Mr. Clark, and in 1902 by the Lake Survey. The 1901 observations show a range exceeding 10°, whereas the 1902 observations show that the temperature was practically uniform from surface to bottom, which may perhaps be ascribed to the influence of the strong winds prevailing at the time of the survey, causing a thorough circulation in the whole body of water.

Loch Kinellan.—Loch Kinellan is a small shallow loch near Strathpeffer, which was surveyed on August 23, 1902. The elevation of the lake-surface was not determined by levelling, but from the Ordnance

[1] See *Geographical Journal*, vol. xxv., p. 281, March 1905.

Survey contours it is evidently nearly 500 feet above the sea. It trends north-east and south-west, widest in the south-western portion, and with a large wooded island near the centre. Weeds abound along the western and south-western shores, and also between the island and the eastern shore. It is one-third of a mile in length, and its waters cover an area of about 15 acres. Soundings of 10 and 11 feet were taken to the north-east of the island, but the deepest part lies to the south-west, the maximum depth of 16 feet having been observed about midway between the island and the southern shore: 73 per cent. of the lake-floor is covered by less than 10 feet of water. The volume of water is estimated at 5 million cubic feet, and the mean depth at over 7 feet. The temperature of the surface water at 12.30 P.M. on the date of the survey was 58·7° Fahr., and at a depth of 14 feet 58·3°.

Loch Ussie.—Loch Ussie (or Usie) is about a mile from Strathpeffer and three miles from Dingwall. It is irregular and subcircular in outline, with a maximum diameter from north-east to south-west of nearly a mile. There is one large island with a heronry upon it, and several smaller ones, and weeds are abundant in some of the bays and in the vicinity of the islands. It was surveyed on August 29, 1902, but the elevation above the sea was not determined by levelling; when visited by the Ordnance Survey officers on September 7, 1870, the elevation was 418·9 feet above sea-level. Its waters cover an area of nearly 200 acres, or less than one-third of a square mile, and it drains an area of nearly 4 square miles. The loch is on the whole very shallow, with a deep hole in the north-eastern part of the loch, in which two soundings of 35 feet were taken; except for a neighbouring sounding of 22 feet the remainder of the lake-floor is covered by less than 20 feet of water, and all the western and southern part of the loch are less than 10 feet in depth. The volume of water is estimated at 68 million cubic feet, and the mean depth at 8 feet. Only 22 per cent. of the lake bottom is covered by more than 10 feet of water, and only 2 per cent. by more than 25 feet of water. At 5.15 P.M. on the date of the survey the surface temperature was 59·3° Fahr., and a reading at 27 feet gave 59·0°.

Loch Glass.—Loch Glass is one of the larger and more important lochs within the drainage basin of the Cromarty Firth, and it exceeds in depth all the other lochs of the basin. It lies in a mountainous district to the north of Strathpeffer, with Ben Wyvis and other peaks exceeding 3000 feet in height to the south-west, and lesser mountains to west, north, and north-east. In trends in a north-west and south-east direction, but with a slight bend in the outline, causing it to appear somewhat crescent-shaped. It is four miles in length, with a maximum width near the centre of two-thirds of a mile, narrowing gradually towards the south-east end, where the river Glass flows out, the mean breadth being nearly half a mile. Its waters cover an area of nearly 2 square miles, and it drains an area exceeding 25 square miles. The maximum depth of 365 feet was observed nearer the north-west than the south-east end, and towards the north-eastern

shore. The volume of water is estimated at 8265 millions of cubic feet, and the mean depth at 159 feet. The loch was surveyed on August 26 and 27, 1902, but the elevation of the lake-surface above the sea was not determined by levelling; when visited by the Ordnance Survey officers on September 1, 1868, the elevation was found to be 712·9 feet above sea-level. Loch Glass forms a simple basin, with very few minor undulations of the lake-floor. The deeper water lies towards the north-west end, and the contour-lines all enclose continuous areas.

Temperature Observations.—An interesting series of temperatures was taken in the deepest part of Loch Glass at 6 P.M. on August 27, 1902.

This series shows a range of temperature from surface to bottom amounting to 12·4°, the greatest fall being one of 5·5° between 50 and 100 feet. The temperatures taken in Loch Achilty six days earlier gave a higher temperature from the surface down to 30 feet than was observed at the surface of Loch Glass, but a lower temperature at 50 feet and 100 feet, the differences being respectively 5·7° and 1·3°.

Loch Morie.—Loch Morie (or Muilie) lies less than two miles to the north of Loch Glass, with the crests of Meall Beag (2121 feet) and Meall Mor (2419 feet) rising between them. It is an important and deep loch, containing trout, but the fishing is preserved. Loch a' Chaoruinn and Loch Magharaidh, which flow into it, could not be sounded for lack of boats. It trends in a north-west and south-east direction, with a slight sinuosity in its outline. It is $2\frac{1}{3}$ miles in length, with a maximum breadth of over half a mile. Its waters cover an area of nearly a square mile, and it receives the drainage from a large tract of the mountainous country to the north-west, the area of which exceeds 35 square miles. The maximum depth of 270 feet was observed in the central part of the loch, but nearer the south-western than the north-eastern shore. The volume of water is estimated at 3201 millions of cubic feet, and the mean depth at 125 feet. Loch Morie was surveyed on August 28, 1902, when the water-surface was found to be 621·6 feet above the sea; when visited by the Ordnance Survey officers on September 28, 1868, the elevation was 622 feet. The loch forms a simple basin, the contour-lines all enclosing continuous areas. The shallower contours follow approximately the outline of the loch, but the deeper ones bend in their central portions towards the south-western shore. The 100-feet basin is over $1\frac{1}{2}$ miles, and the 200-feet basin is over a mile, in length. The slope of the bottom is in some places very steep—for instance, off the south-western shore towards the north-west end, where a sounding of 75 feet was taken about 60 feet from shore, and one of 124 feet about 120 feet from shore, showing in each case a gradient exceeding 1 in 1. The temperature of the surface water was 54·0° Fahr. on the date of the survey, but serial temperatures could not be attempted on account of the gale that was blowing.

Loch Eye.—Loch Eye is a rather large but very shallow loch, about three miles from Tain and a mile from Inver Bay, an inlet of the Dornoch Firth. It was surveyed on September 26, 1902, when the surface of

the water was found to stand 47·8 feet above the sea; on December 24, 1867, the Ordnance Survey officers found the elevation to be 50·7 feet above sea-level, or 3 feet higher than in 1902. The loch is 1¾ miles in length, with a maximum width of nearly two-thirds of a mile, and covers an area of over 210 acres, or one-third of a square mile. The maximum depth is 7 feet, and the mean depth 4 feet, the volume of water being estimated at 37 million cubic feet. The loch is a flat-bottomed shallow basin, 45 per cent. of the lake-floor being covered by more than 5 feet of water. The temperature of the surface water on the date of the survey was 54·8° Fahr., while a reading at the bottom in feet gave 55·0°.

NOTES ON THE GEOLOGY OF THE CONON BASIN.

By B. N. Peach, LL.D., and John Horne, LL.D., F.R.S.

The rock groups entering into the geological structure of the Conon basin and the area including Strath Glass and Strath Rusdale, north of Ben Wyvis, belong to the crystalline schists and the Old Red Sandstone. A line drawn from a point in Strath Rusdale above Ardross Castle, south-west by Eileneach in Strath Glass, Achterneed station, the Falls of Rogie, and across the Conon to Glen Orrin above Muirtown House, roughly marks the boundary between the metamorphic rocks to the west and the Old Red Sandstone bordering the Cromarty Firth. It will thus be seen that the crystalline schists form not only the greater part of the basin, but also the highest and wildest territory.

From the researches of the Geological Survey, extending over the greater portion of the area under description, it would appear that the metamorphic rocks may be arranged in two divisions: (1) a group of acid, basic, and ultrabasic rocks, resembling certain types of Lewisian gneiss of pre-Torridonian age along the western seaboard of Sutherland and Ross; (2) the Moine series, representing altered sediments and including the main subdivisions, (*a*) granulitic quartz-schists or quartz biotite granulites, (*b*) flaky muscovite biotite schists or gneiss frequently garnetiferous, and passing into flaggy mica-schists (pelitic schists).

Though the group of rocks of Lewisian type comprise certain acid granulitic gneisses that closely resemble the quartzose members of the Moine series, yet their dominant feature is the alternation of acid and basic materials in the form of biotite and hornblende gneisses. With these are associated bands of garnet, amphibolite, and hornblende-schists that have been mapped for some distance both in the Fannich mountains, and near Scardroy, in the basin of the Meig. In some areas schists of ultra-basic type appear that represent original masses of peridotite. This group forms isolated areas or inliers in the midst of the Moine series, being regarded as older than the latter, and probably representing the floor or platform on which the members of the Moine series rest. It is significant that different bands of the so-called Lewisian gneisses in the Conon basin are in contact with the crystalline Moine schists of sedimentary origin, and that different subdivisions of the latter overlap the former.

These gneisses of Lewisian type appear at intervals, sometimes forming comparatively narrow zones, and, again, rather broad belts. On the north and west slopes of the Fannich mountains they had been traced for several miles, being there overlain and underlain by the flaky muscovite-biotite schists of the Moine series. Southwards between Strath Bran and the basin of the Meig, near Scardroy,

there is a large development of them, where their relations to the Moine schists are well displayed. They likewise appear in Glen Orrin, and southwards towards Glen Strathfarrar, and eastwards near Loch Luichart.

With the exception of certain masses of foliated and unfoliated, intrusive, igneous rocks, the members of the Moine series occupy the rest of the area covered by the crystalline schists. Their lithological characters are comparatively uniform. The two main subdivisions, already indicated, graduate into each other in certain localities, thus forming an intermediate type between the highly quartzose granulitic schists on the one hand, and the flaky muscovite-biotite schists on the other. The members of the Moine series, which have the largest development and the widest distribution, consist of granulitic quartz-schists or quartz-biotite granulites, but the pelitic schists sometimes form the most elevated ground, as, for instance, on Sgúrr Mor Fannich (3637 feet), the highest of the Fannich mountains.[1] The boundary-line between the two main subdivisions of the Moine series is highly involved, showing intricate rapid folding, frequently isoclinal, and pointing to intense reduplication of the strata. The most prominent belts of the garnetiferous muscovite-schists have a wide distribution in the basin of the Conon. For example, they appear in the Fannich mountains, and extend south-west by Ben Fionn and Loch Rosque to Moruisg, east of Glen Carron. They likewise appear in Glen Orrin and Glen Meig, and prominent bands have been traced more or less continuously from Strath Bran north-north-west by Aultguish and the hills west of Strath Vaich to Glen Beg and Glen Alladale, in the basin of Strath Carron. Still further east, this characteristic zone has been followed from Ben Wyvis across Strath Glass and Strath Rusdale to the hills near Fearn.

The constant reappearance, throughout the metamorphic area of the Conon basin, of the two main subdivisions of the Moine series suggests the repetition of those zones by folding. Indeed, such is the view adopted by the Geological Survey, and hence the actual thickness of this series may be much more limited than the persistent dip of the strata in one direction would lead us to suppose. The researches of the Survey indicate a probable order of succession in these schists which obtains in the tract between Ben Wyvis and Ben Dearg, and between Garve and the Carron that flows into the Dornoch Firth.

In the flaky muscovite biotite schists, and in the quartzose granulites, bands of garnet amphibolite and hornblende schists occur, which have a wide distribution and are characteristic of certain horizons.

Reference must now be made to the foliated granite, intrusive in the Moine series, which is one of the most interesting features in the geology of the Conon basin. Its boundaries are of prime importance, because the distribution of the boulders supplies valuable evidence regarding the direction of the ice-flow during the glacial period. There are two important masses of these older intrusive rocks. The larger one extends from Carn nan Aigheinn, near the head of Strath Rannoch, north-east by Carn Chuinneag to Cnoc an Liath-bhaid beyond Strath Rusdale, and measures about twelve miles in length and about five miles in breadth. The smaller one stretches from the hills above Loch Luichart north-east by Inchbae to Carn More east of Strath Rannoch, being about five miles long and less than three miles broad. Again, on the north shore of Loch Luichart there are four outcrops of foliated granite, evidently belonging to the same set of intrusions. The Inchbae type of augen-gneiss or granite is well known, with large porphyritic

[1] The quartz-schists contain pebbly bands in places, thus clearly showing their derivative origin.

crystals of orthoclase felspar oriented in a definite direction, enclosed in a granulitic ground-mass of quartz, felspar, and micas, together with crystals of garnet and sphene. This coarse porphyritic variety is largely developed in the Carn Chuinneag mass, where it is associated with foliated riebeckite granite or augen gneiss. Frequently the rock is fine-grained, and merges into a finely crystalline schist.

Evidence has been obtained that these older granite masses with their basic modifications were intruded into the series of Moine sediments before they were converted into crystalline schists. A well-marked aureole of contact metamorphism accompanied this intrusion, which in places has been obscured by subsequent deformation. But at intervals round the margin the sediments are hornfelsed, and still show their original bedding-planes, while garnets and crystals of andalusite have been developed. It is further apparent that the granite masses and the Moine sediments have been subjected to a common series of dynamic stresses: for the planes of schistosity in the granite are parallel to those in the Moine schists; indeed, in certain localities they pass, irrespective of the boundary-line, from the igneous to the altered sedimentary rocks.

On either side of the Sutors of Cromarty, and stretching southwards along the sea-cliff to Fortrose, there is a narrow belt of crystalline schists rising from underneath the Old Red Sandstone. They belong to the group of quartz-biotite granulites, and are associated with bands of amphibolite.

Newer granite masses are also represented in the area, as, for instance, on the hills north of Ardross Castle above Strath Rusdale, and in Glen Orrin west of Fairburn House. They resemble the normal types of the newer granite masses of the Highlands, and were erupted after the Moine schists had assumed their present crystalline character.

The strata of Old Red Sandstone age in the basin of the Cromarty Firth are arranged in the form of a great syncline, whose axis runs in a north-north-east and south-south-west direction. The base of the series and the order of succession are admirably displayed on the sea-cliffs at Cromarty, and on the south-east shore of that firth as described long ago by Hugh Miller. The basal conglomerate is there overlain by the well-known fish-band, with calcareous nodules, graduating upwards into the coarse sandstones that form the centre of the basin. On the west side of the firth a similar sequence is observable. The basal conglomerate along the flanks of the hills is usually brought into conjunction with the crystalline schists by a fault, evidently of no great amount, for the unconformity is visible at certain localities. This horizon is surmounted by red sandstones and flag-stones, calcareous and bituminous shales, and occasional intercalations of clays with limestone nodules, with fish remains. These are followed by an upper band of conglomerate, which is overlain by the coarse sandstones in the centre of the basin.

Various outliers of Old Red Sandstone, largely composed of conglomerate, and resting unconformably on the highly denuded platform of crystalline schists, occur some miles to the west of the main area of this formation in the Conon basin. Some of these are met with on the plateau between Loch Luichart and Aultguish. By far the largest and most important is that still further north in Strath Vaich, where an extremely coarse conglomerate, composed largely of blocks of the contiguous foliated granite, is found on the crest of Meall a' Ghrianain (2531 feet).

At the base of the sea-cliff formed by the crystalline schists and Old Red Sandstone of the Black Isle and the North Sutor, there are small patches of Oolitic rocks which have only a limited development. They occur on the beach below high-water mark at Eathie and at Port-an-Righ and Cadh-an-Righ near Sandwick.

By means of the great fault that traverses the line of the Caledonian Canal, and is continued north-east along the shore of the Black Isle, these Secondary strata have been let down against the older rocks.

Regarding the lines of displacement in the Conon basin, one of the most important is that just referred to, which skirts the base of the Black Isle, and is prolonged north-east to Tarbat Ness, whereby this straight feature has been determined. The great fault that traverses Loch Maree and Glen Docherty passes south-east by Ledgown, thence across the watershed by Carn Chaorainn to Loch Beannachan in the basin of the Meig. Another powerful dislocation, nearly at right angles to the course of the Loch Maree fault, has determined the north-north-east direction of the Meig valley between Inbhir-Chaorainn and Milton of Strathconon, and stretches south-west up Glen Chaorainn in the direction of Loch Monar, and north-north-east to the head of Loch Luichart.

During the period of extreme glaciation it would appear that the ice-shed lay some distance to the east of the existing watershed in part of the Conon basin, for boulders of foliated granite or augen gneiss, from one or other of the masses near Inchbae, have been carried westward into the valley of Loch Broom, to Inverlael, and nearly as far as Ullapool. Their distribution in an eastward direction is no less remarkable, for they have been traced as erratics across the Black Isle and the Moray Firth to the plain of Moray and the low grounds of Banffshire. The boulder clay of the north part of the Black Isle contains numerous blocks of this well-known rock, which were probably dispersed during the greatest extension of the ice. Such evidence is in harmony with that obtained in the Assynt district, where blocks of the eastern schists have been carried from the plateau of the Moine schists, east of the existing watershed, to higher elevations to the west, formed of Cambrian strata. In view of these facts, it seems probable that, during one stage of the glacial period, the Conon basin must have been buried under an ice-sheet that overtopped the highest hills, the movement of which was largely independent of the physical features of the region.

During the period of confluent glaciers that ensued, the great mountain groups formed more or less independent centres of dispersion. Indeed, many of the striæ, the disposition of the moraines, and the distribution of the carried blocks, furnish evidence relating to this phase of glaciation. In the Fannich mountains—a range running east and west for about 7 miles, and whose main peaks rise above 3000 feet—ice-markings were found on the southern slopes at elevations between 2250 and 2500 feet trending south-south-east. Striæ pointing in a similar direction occur at various points on the ridge between Loch Fannich and Strath Bran, thus showing that at one period the Fannich ice must have crossed that loch into the Bran valley. Again, during this later glaciation, ice crossed the watersheds from Glen Fhiodaig and from Strath Conon into the valley of the Bran, and after uniting with the glaciers from Fannich and the Black Water, passed eastwards by the Conon valley towards the Black Isle. The striæ, trending about east-south-east, found on the tops of Meallna Speirag and Beinn Liath Beg at elevations of about 2000 feet, on the watershed between the Black Water and the streams flowing into Loch Luichart, clearly show the development of the ice during this period.

Important evidence regarding the transport of materials during the time of the confluent glaciers is furnished by the distribution of boulders of foliated granite and Old Red Sandstone on the slopes of Ben Wyvis. These have been carried from the west or west-north-west, and have been traced up to a height of 2400 feet on Carn Gorm and Little Wyvis, while their upper limit on Ben Wyvis itself is 2300 feet. It is further apparent that the ice moved through the pass between

Little Wyvis and An Cabar, and streamed down the valley of Loch Glass north of Ben Wyvis. Still further north in Kildermorie Forest and Strath Rusdale, the direction of the ice-flow was south of east, as proved by the striæ, and the transport of boulders of foliated granite or augen gneiss. From the period of confluent glaciers to the time of their disappearance in the upland glens, the various stages of retrocession are represented by the moraines.

Loch Fannich.—The soundings clearly show that this lake gradually deepens towards the eastern portion, the deepest sounding, 282 feet, being situated about a mile above the outlet. The hill-slopes on both sides of the loch for considerable distances are covered with morainic drift, save near the outlet, where there is a prominent barrier of rock. At the latter point the southern spur of An Coileachan approaches the northern margin of the lake, and is prolonged on the south side in An Cabhar and Carn na Beiste. Along the eastern side of this ridge, the quartzose granulites and muscovite-biotite schists are isoclinally folded on vertical axes striking north and south—that is, at right angles to the course of the lower part of the loch. At the outlet, and for a mile below that point, fhe Grudie river flows on alluvial deposits, these materials having been largely contributed by side streams, and especially by Allt a' Choin Idir, draining from the north. Beyond the alluvium, at the 800-feet level, the Moine schists are exposed in the bed of the river and on the hill-slopes, and there is here no indication of a preglacial river-channel filled with drift. The surface of Loch Fannich is 822 feet above Ordnance datum, so that the depth of the rock basin below the rocky barrier visible about a mile beyond the outlet is 260 feet.

Loch Luichart.—This lake is a true rock basin lying among the crystalline schists, with a barrier formed of these materials at its outlet. Where the stream issues from the loch, it runs through a narrow gorge of rock and over successive waterfalls. In this sheet of water there are three basins, of which the most westerly is the most important, its greatest depth being 164 feet. The surface of the lake is 250 feet above Ordnance datum line. The axis of the upper part of the loch coincides with the strike of the crystalline schists, while that of the lower is obliquely across it. It is interesting to note that the deepest basin has been excavated out of the flaky muscovite-biotite schists, while the shallow part about the middle of the loch north of Creag Mhor corresponds with a belt of highly siliceous Moine schist folded over a core of gneiss of Lewisian type. The head of the lake nearly coincides with the Strath Conon fault already referred to, which crosses the lake in a north-north-east direction, and has there produced considerable brecciation of the strata. Only a small part has been silted up at the western end by the alluvial material brought down by the Bran and the Grudie.

Loch a' Chroisg and Loch Cran.—The former lake is evidently a rock basin for, though at its outlet it flows over alluvial deposits that mark the site of an old lake, the rocky barrier appears about two miles east of Achnasheen, where the 400-feet contour-line crosses the Bran river. The surface of the loch is 508 feet above Ordnance datum, and the deepest sounding is 168 feet, so that the depth of the loch below the rocky barrier beyond Achnasheen is 60 feet. Loch Cran has been separated from Loch a' Chroisg by a cone of alluvium brought down by the streams on both sides of the valley at that point.

Loch Achanalt and Loch a' Chuilinn represent the remains of a lake which once extended for four miles up the valley to Dosmuckeran, the level of which has been lowered by the Bran. The materials cut through during this process of denudation consisted of moraine matter, but the river has now reached the solid

rock. The terraces round Loch Achanalt and Loch a' Chuilinn rise to a height of 20 feet above the surface of these sheets of water. The deepest sounding in the former is 9 feet, and in the latter 43 feet. While Loch Achanalt is being rapidly silted up by alluvial detritus, Loch a' Chuilinn preserves its character of a rock basin. At its outlet the water flows over an ice-moulded surface of granulitic quartzose schist. The strike of the strata is nearly parallel with the long axis of the loch.

Loch Beannachan.—As already indicated, this lake lies along the line of the powerful fault that has been traced in a south-east direction from Loch Maree, and Glen Docherty.

Loch Garve is evidently the remnant of a much larger sheet of water that formerly extended from Little Garve down to the Falls of Rogie—a distance of about four miles. The former level of the lake has been lowered by the erosion of the drift deposits and the cutting of the rock gorge at the Falls of Rogie. The surface of the present loch is 220 feet above Ordnance datum line, and the deepest sounding is 105 feet. The 200-feet contour-line crosses the stream at these waterfalls. Hence, on the assumption that the Moine schists and epidiorite sills exposed at the latter locality formed the original rocky barrier of the lake, the depth of water below this level in Loch Garve is still 84 feet.

Loch Achilty.—Though this lake is small, its extreme depth (119 feet) is remarkable. There is no proof that it occupies a rock basin, but it is not improbable that such may partly be the case. Towards the east it has been filled in by the delta gravels of the Black Water, and on the other side by those of the Conon at the time of the formation of the 100-feet beach.

Loch Ussie is a shallow basin, 35 feet in depth, resting in drift; and *Loch Kindlan* appears to be banked by superficial deposits at the west end, while at its eastern margin the bituminous shales of the Old Red Sandstone are exposed. Its greatest depth is only 16 feet.

Loch Morie is obliquely traversed by a line of fault, with a downthrow towards the south-west, that branches westwards in the upper part of the basin. Each branch shifts the outcrop of the zone of altered strata in contact with the mass of foliated granite already referred to. The stream issuing from the lake flows over a rocky barrier, but it is possible that there may have been a former outlet now concealed by drift.

Loch Glass.—Round the north-east margin there are traces of terraces between Culzie Lodge and the foot of the lake. No rocky barrier appears till the Falls of Eillenach are reached, where the stream flows over a mass of conglomerate of Old Red Sandstone age at an elevation of about 680 feet. As the surface of the loch is 713 feet above Ordnance datum line, and the deepest sounding is 365 feet, it follows that the depth of water in Loch Glass below the level of the barrier at the Falls of Eillenach is 332 feet.

Loch Eye lies on the stratified deposits of the 100-feet beach.

NOTES ON THE BIOLOGY OF THE LOCHS IN THE CONON BASIN.

By James Murray.

The lochs dealt with in this paper, with the exception of Loch Eye, which will be separately noticed, have the plankton of a very uniform character. The fauna includes only those species which are common to the whole country, and calls for little detailed notice. The most important feature in it is the total absence of all those species of *Diaptomus* (*D. wierzejskii*, *D. laticeps*, *D. laciniatus*), which are

common in the districts to the north and south of the Conon valley. This valley, extending nearly across Scotland, forms a line of interruption in the distribution of those species, a line completed towards the west by Lochs Maree, Dhughaill, and Sgamhain, all of similar character. Any slight peculiarity in the fauna will be noted under the name of each loch.

In contradistinction to the absence of western species in the fauna of these lochs is the occurrence in the flora of several Desmids of the western type. These western Desmids, though less numerous than in districts both to the north and south, are in most of the lochs.

Loch Gowa, North and South.—These very shallow basins had an admixture of littoral species in the plankton, and the numerous Desmids included both pelagic and bog species.

Loch a' Chroisg.—The only peculiarities of this loch were the abundance of algæ and of the smaller pelagic animals, such as Rotifera and Protozoa. *Floscularia pelagica*, Rousselet, was abundant.

Loch Achanalt.—Owing to its shallow weedy character, littoral species were more numerous than pelagic ones. A species of *Gammarus* was of a bright slaty-blue colour. *Ophridium* was abundant on the weeds.

Loch a' Chuilinn.—Among the Rotifera observed were *Euchlanis lyra*, *E. dilatata*, and *Plasoma truncatum*. The Desmid *Staurastrum arctiscon* was frequent.

Loch Fannich.—As in most of our largest lakes, there were skeletons of *Clathrulina elegans* floating in the water. Although this is not a true plankton organism it lives attached by a stalk to plants, the skeletons have seldom or never been observed during the Lake Survey work except in large lakes, while it has rarely been seen living at the margins of those lakes. The lightness of the skeletons, enabling them to float on fresh water, may serve for the distribution of the species, and small cysts are commonly seen in them. Granting this, their absence from smaller lakes is still unexplained. The only suggestion I can offer is that the lower specific gravity, resulting from the higher temperature of smaller lakes, may prevent the floating of the skeletons, or that the higher temperature may lead to a more rapid decomposition of the material of which they are composed, and so prevent their accumulation in the water.

Loch Garve.—There was nothing peculiar in the plankton, except the apparent absence of Desmids.

Loch Luichart.—In contrast with the neighbouring Loch Garve, Desmids were here abundant, and other algæ were also numerous.

Loch Achilty.—Desmids were numerous, including, among species of the western type, *Staurastrum arctiscon*, and *S. jaculiferum*.

Loch Kinellan.—*Ceratium hirundinella* was very abundant, in a form with long divergent middle horns. There were also observed *Volvox globator*, *Asterionella* with very short rays, a species of *Ceriodaphnia*, and a few larvæ of *Corethra*.

Loch Ussie.—*Ceratium hirundinella*, of the same form as in Loch Kinellan, was the most abundant organism. This was the only loch in the district in which *Latona setifera* was seen.

Lochs Glass and *Morie* have no peculiarity worthy of remark, except the much greater abundance of algæ in Loch Glass.

Loch Eye.—This loch, which is only considered along with the Conon lochs as a matter of convenience, really approximates biologically to the lochs of the Shin basin, and of Sutherland generally. It is remarkable for the abundance of

Diaptomus wierzejskii, this being the most southern locality on the mainland where the type of the species has been observed by the Lake Survey, though it extends much further south in the Outer Hebrides, where Dr. Scott got it in Barra. The Rotifer *Triarthra longiseta* was also abundant.

COLONEL HARDING IN REMOTEST BAROTSELAND.[1]

A REVIEW.

By S. H. F. Capenny.

The name of Colonel Harding has now been associated for half a decade with Barotseland. When he assumed office in November 1899, the Barotse kingdom had become, at the request of King Lewanika, a British Protectorate. Its limits were undefined, if not unknown; and little was known about the greater part of the country. Colonel Harding had, therefore, been instructed to explore this new territory and report upon it. In his *Remotest Barotseland* he gives an account of four journeys, based on his notes from day to day. His book is therefore divided into four parts: the first deals with the course and source of the Zambezi; the second, with a journey from the Upper Zambezi to Bihe in Angola and thence to Lialui, the capital of Barotseland; the third, with a journey to the Batoka country, the Zambezi, and the Kafue; the fourth, with a visit to the source of the Kabompo. In the following account, this order will be followed.

Colonel Harding begins his account with his arrival at Kazungula, on the left bank of the Zambezi, some 38 miles above the Victoria Falls, and some 300 miles from Bulawayo. Kazungula has long been recognised as a drift or point for crossing the Zambezi, and can claim quite a historical reputation from the many invasions which have been made across the Zambezi there into the Barotse kingdom. "Kazungula," he says, "is by no means a sanatorium, but though unhealthy, the beauty of the 460 yards of water that divided us from the opposite bank was very great. The sunsets were glorious, lighting up the river as evening drew on with a glow of colour of exquisite variety and beauty. Occasionally we would sail out to pass an hour or two down the river reaches in a welting flood of crimson and gold in the west, the far-off cry of some wild bird alone breaking the glowing silence of the evening, while, in spite of the scene of romance and dreams around us, we would practically replenish our larder with the large tiger-fish which abound at this point, and make an excellent dish for the hungry traveller, eaten under the dim light of the stars and the brightness of our own cheery camp fires." Colonel Harding was accompanied by his

---

[1] *In Remotest Barotseland: Being an Account of a Journey of over 8000 miles through the Wildest and Remotest Parts of Lewanika's Empire.* By Colonel Colin Harding, C.M.G., F.R.G.S., Acting-Administrator of North-West Rhodesia, Commandant Barotse Native Police. London: Hurst and Blackett. 1905. Pp. xv–413. Map of author's route. *Price* 10*s.* 6*d.*

brother, Mr. W. Harding, who was acting as his secretary, and by Mr. Gifford Moore, who came as accountant. As they had left the wagons a hundred miles in rear, having proceeded on horseback from Bulawayo to the Zambezi, Colonel Harding visited the Victoria Falls and the police-stations in the Batoka country, leaving his companions at Kazungula. On his return the wagons arrived, and, after a delay of three weeks, the boats from Lewanika arrived for the ascent of the Zambezi, and along with them a note of welcome to Barotseland from the Rev. Mr. Coillard, the head of the "Paris Evangelical Mission" at Lialui. As Mr. Moore had been sent to the Batoka country, Colonel Harding and his brother began their ascent of the Zambezi on a bright November morning. The expedition consisted of twenty boats. The horses and mules had been sent overland a few days earlier in charge of Sergeant Macaulay of the British South Africa Police. On the second day, at sundown, Colonel Harding and his flotilla arrived at Sesheke, a distance of 55 miles from Kazungula. Sesheke is a mission station. It is very unhealthy, and "can with difficulty be surpassed as a deadly malarious hotbed." There he found Sergeant Macaulay prostrate with fever. Putting him, therefore, in his own boat, Colonel Harding took his place with the horses and pack mules and travelled to Lialui overland. On the day of his arrival at Mongu, the British Residency, near Lialui, he received a letter from Lewanika welcoming him to Barotse. "The king," he says, when he paid his first visit to Lewanika, "was arrayed in an alpaca coat, fancy waistcoat, brown boots and trousers, and a black felt hat; he met me outside the court-house, deferentially, and with a dignity of mien which much surprised me, and politely welcomed me, and bade me precede him." Colonel Harding had been at Lialui a week when his brother and Macaulay arrived with the boats.

After writing several reports and getting the camp put into shape, he left Macaulay in charge, and set out to visit the Upper Zambezi. The king provided twelve boats, sent some of his indunas, and took advantage, as was intended, of Colonel Harding's visit to send messages to his vassals. For this purpose a phonograph was used, and this instrument, when it sounded forth the words of Lewanika, afforded unbounded surprise. It was also used to receive their professions of fealty to Lewanika. It was on January 19, 1900, that everything was ready for the start up the Zambezi; the objectives in the first part of the journey were Kakengi and Nyakatoro, the two principal stations, about 320 miles up the river. At that season the Zambezi is in flood, inundating the Barotse valley. After three days they were fairly out of the Barotse valley, and wholly out of it after six days. No obstruction was met with till the Sapuma rapids were reached. Throughout his journey Colonel Harding summoned the chiefs along his route. One of the first was Mokengi, a brother of Kakengi. "I had not yet seen the Kakengi," says Colonel Harding, "but if at all like his brother, I felt their parents must be unfortunate to an exceptional degree, for a truer type of a Caliban it has never yet been my misfortune to meet. The teeth were filed to sharp points, and after a sentence come together like a rat-trap; his brow receded, his chin ran away from his face, his

shoulders sloped like a champagne bottle, and altogether a more repulsive, ill-formed, and grotesque being I have never met." His conduct did not belie this anticipation of his character; and his brother, Kakengi, proved to be even worse: "Kakengi himself is a middle-aged man of medium height, with the bloated appearance of the habitual drunkard. During his paroxysms of drink he is capable of most ferocious deeds and hideous atrocities. At these times his brutality is notorious, and only equalled by his immorality." When Kakengi was created governor of the district, however, by Lewanika, he was a sober and, for a native, an industrious man; but within the last few years he had developed into a dipsomaniac, craving for his Kaffir beer and Portuguese brandy. At

Fig. 1.—Valovale Chiefs at Nyakatoio.

Kakengi Colonel Harding first met one of the Portuguese commandants, with whom, as throughout his journey, he kept up friendly relations, but obtained assurances of Kakengi's fealty to Lewanika. After some weeks, during which the country was explored and mapped, a new start was made. Colonel Harding had chosen the rainy season for his journey, and was thus able to utilise the Zambezi; but his account of the hardships tells for the dry season. "Those alone," he writes, when on his way to Kakengi, "who have travelled during a wet season in tropical Africa can fully picture or realise the discomforts and hardships with which one has to combat in that time. Everything is in a soaked and sodden condition. One's clothes are never dry, one's food ferments and perishes, and one's steps are constantly dogged by the persistent and venomous malarial microbe. Quinine you take as regularly as your

dinner when in England, and your spirits sink to the lowest ebb of despondency and despair. The servants and carriers (or, as in our case, the rowers) are either unable or too lazy to perform the round of their duties, and though perhaps provided with two cooks, you have to perform the culinary work yourself as often as not, however tired out in condition or temper." Kazombo, a mission station, was the next place of any importance after Kakengi, and thence it was some 30 miles overland to Nyakatoro. Colonel Harding hoped to use the river, but was obliged to abandon it after a while and strike across country. Nyakatoro is the capital of the Valovale and the residence of the Queen; it is an important place in relation to the great trade route to the West Coast. It is a mission station and also a Portuguese fort. As it is generally believed that the Barotse came from the south of the Zambezi, it is worthy of note that, according to the tradition of Nyakotoro, the Queen and Lewanika are blood relations, and are descended from a royal house which formerly lived near Lake Dilolo and the Kasai River.

On the 5th of March Colonel Harding left the Valovale country to visit the source of the Zambezi. He now passed through the territory of the Malunda tribe. They are quite distinct both in language and costume from the Valovale; they do not recognise Nyakatoro's authority, but acknowledge as their chief Shinti, an induna who lives on the Kabompo and is a vassal of Lewanika's. After one failure in locating the source of the Zambezi, Colonel Harding succeeded in achieving his quest. "The source," he says, "is composed of numerous springs, surrounded with a jungle of luxuriant trees interlaced with thick creepers, tall bracken, and many and various plants adapted to a wet and heavily shaded soil. Fungus grows abundantly, and its vivid scarlet contrasts brilliantly with the dark soil and the deep green of the heavy foliage. The height of the source reads at about 5200 feet, and a more healthy spot could hardly be imagined." Colonel Harding then returned overland 240 miles to Nyakatoro, having travelled 1145 miles since leaving Kazungula. He estimates the distance from the Victoria Falls to the source of the Zambezi at 943 miles; Victoria Falls to Kazungula, 38 miles; Kazungula to Sesheke, 55; Sesheke to Lialui, 230; Lialui to Nyakatoro, 320; Nyakatoro to the source of the Zambezi, following the river, 300.

On Good Friday, 13th April, Colonel Harding left Nyakatoro for Chisamba Bihe in Angola, a distance of 560 miles. It was his aim to interview all important chiefs along the route, visit the Portuguese forts, and report generally on the country. The general direction of his route followed the great highway of trade which has long been used by the Mambari of the West Coast, the Garanganze route to Katanga. The route passes through Kalunga Kameya (255 miles), Mosiko Fort (64), Matota Fort (125), Quanza Fort (43), Chisamba Mission Station (35), which is a small village at Bihe composed wholly of the American Mission and its Christian natives. On his way to Lialui from Chisamba he passed through Kalomo, 356 miles, and thence 212 miles to Lialui, where he arrived on the 20th of June. During this journey he trekked 55½ days, making a daily average of 19·6 miles. The Baluchazi was the most important tribe, and their country is noteworthy for its produce of

rubber. "The Baluchazi," he says, "are a finer race than the Valovale. The women wear their hair long, coming down two or three inches each side of their head; on the top it is ornamented with small sea-shells. They have intelligent faces, without the thick lips and broad nostrils so noticeable in natives as a rule. Their necks are covered with red beads, and their ankles encircled with brass anklets. The principal fare is mealies, or chovongo, as the Biheans term it." The day after his arrival at Lialui, Lewanika and his principal indunas came over to thank him for taking the journey, and to congratulate him on his safe return. "No other chief," said Lewanika, "has seen my country like you, and from my heart I thank you." On his return journey, Colonel Harding was met at Kalomo by Sergeant Macaulay, who has since been promoted, having

Fig. 2.—Breakfast: Col. Harding's Native Mounted Servant.

obtained a commission in the Barotse Native Police, and been appointed District Commissioner at Kasempa.

Colonel Harding's third journey, from July to September 1900, led from Lialui to the Victoria Falls and thence to Kalomo and Monze in the Batoka country, then along the Zambezi and the Kariba gorge to the Kafue, and up the Kafue to visit the Balungwe or Mahuminia Falls or Rapids. The Batoka tableland is some 50 miles square, well-fitted for farming, with good water, good grazing, excellent shooting, and the healthiest of climates, in a district some 4500 feet in altitude. In this journey, Colonel Harding was accompanied by a mounted native servant, Breakfast, "superbly dressed, immaculately clean, and possessing a wardrobe, the wonder of his companions and envy of myself." The natives on the river are Batonga, and are quite distinct from the Batoka.

The Bantua are another river-tribe along the Zambezi. From the junction of the Kafue and the Zambezi Colonel Harding proceeded to visit the Balungwe Falls. These are rather rapids or cataracts, with a picturesque graduating descent of two miles. "The river, here," he says, "some 150 yards wide, is a white boiling mass, a roaring, dashing torrent, leaping over huge bouldered terraces, rushing madly between insurmountable rocks, watering the foliferous plants that gratefully thrive by the river brink, forming a pleasing contrast to the parched and stunted shrubs that struggle for an existence in the rocky subsoil up the river." After leaving the Falls he arrived in two days in Mashukulumbwe country.

When he left Lialui in June, Colonel Harding had arranged to meet his brother at Nkala in order to visit the source of the Kafue, pass thence

FIG. 3.—Balungwe or Mahuminia Falls or Rapids, Kafue River.

to that of the Kabompo, and then return to Lialui. It was now necessary, however, to proceed to Lialui, some 270 miles from Nkala, in order to meet Mr. Coryndon, the Resident. Colonel Harding then decided to visit the source of the Kabompo. He proceeded to Kasempa, 250 miles, and thence to the source of the Kabompo, some 200 miles, which is not unlike that of the Zambezi, surrounded with luxuriant vegetation in the midst of a huge thicket of dense trees. "I consider," says Colonel Harding, "the watershed of the Zambezi and Congo rivers a district that will repay the greatest attention, and if mineral wealth is to be found in West Central Africa it will be located in these parts."

It was in October that Colonel Harding left Lialui for the source of the Kabompo, and it was the end of January before he returned, after covering some 2000 miles. After remaining a while at Lialui, the only rest since he had arrived eighteen months before, he left for the Batoka

country in February. On arriving at Kazungula he heard of the illness of his brother, who, after their parting at Nkala, had visited the copper mines east of the Kafue, and when halfway between the Falls and Monze he heard of his brother's death.

When Colonel Harding was home for a holiday in England, King Lewanika had been invited to the coronation of King Edward, and the duty devolved on Colonel Harding of accompanying the Barotse king both during his stay in England, and his journey to Barotseland. Colonel Harding in his last chapter gives an appreciative account both of the Barotse king during this time, and of the statesmanlike character of Lewanika.

Colonel Harding's book is a most vivid and fresh account of these remote parts of the empire. Based as it is on his notes day by day, it enables the reader to follow the life and work of those who amid many hardships are engaged in Britain's imperial work, and to behold those little known lands and peoples through the mind of an officer and gentleman.[1]

A GREAT GEOGRAPHER: ELISÉE RECLUS, 1830-1905.

By Professor Patrick Geddes.

I.

The writing of biography is plainly one of those fields which must longest await reduction to scientific methods. Here most of all, amongst the puzzles of evolution, the difficulty seems supreme, the complexity greatest. Each individual is at his best unique, and the great man is a culminating product of past tendencies and forces, all hard to unravel, and perhaps yet harder to estimate at their respective importance, whether for him or for the world. Such in fact is the many-sidedness of every full life, every developing and varied career, that we may have as many biographies as there chance to be biographers, perhaps as many fresh interpretations of these as they find reflective readers. Yet here is no mere confusion, but the early struggle of what may be developed into distinct methods of biographic treatment, and these only in appearance rival ones. In the study of lower forms of life the first investigator gives himself especially to the task of formal and outward description of the adult organism as he sees it; another dissects, another classifies. Soon, however, some other complements these presentments—all too static—by inquiries into the inward life and its functioning; another by a study of the life in its wider outward relations to its fellows, its struggle of love and hunger amid the great world—its whole environment, in short. But none of these investigators is as yet fully an evolutionist; hence new schools of workers must take up the task. One reinvestigates the developments of individual infancy, or of such metamorphoses as that which in our own species we

[1] The illustrations accompanying this paper are from Colonel Harding's book, and we are indebted to the publishers for the use of the blocks.

are beginning to appreciate as adolescence. Another strives to unearth the essential secret from the strata of ancestral history. Neither description, however complete, of racial origins nor of individual phases of development, can satisfy us. Phylogeny and ontogeny must be united, and each alike needs to become rational. For this the eventful outward struggle for existence must be examined anew, and anon the inward temperament and tendency re-read.

All these various lines of investigation have still to be harmonised; and only then, out of contending or isolated specialisms, shall we have an adequate biology. So it is with analogous studies in the world of men. Hence the sociologist struggles to unify the vast, but almost chaotic materials, which anthropologist and scholar, historian and economist, and many more are ever pouring upon him, each careful as to his own facts, but seldom heedful of their general bearing. The social psychologist, the biographer, cannot wait till all these sciences are completed; for him even more than for all others the stream of phenomena never ceases, its events must be taken as they come, observed and recorded at least, interpreted as far as may be.

Without waiting, then, for a completed method of biography, we may best progress towards this by making the most of existing ones, which indeed need little more than to be specialised here and generalised there—each one developed to the utmost possible, yet all taken together. Thus our collection of annals can hardly be too complete, even if outer facts, circumstances, events, seem apparently small; for it is in biographical interpretation as in medical diagnosis; a detail, a symptom is no longer trivial when we can read its meaning. Still, however we may hold with some that a Boswell's value lies largely in his own pettiness, our records must essentially be of the phases of personal development, and of their characteristic expression, their essential productivity. Given these annals, then, in their continuous serial presentment of the years, we have to reconstitute the essential phases of life; the child in his parentage and home, the youth at college, and in the larger environment of his wander-years, settling to life and work, his outward crises, his inward developments. We must consider all these in themselves, and in their reaction upon the maturing life-work: and so prepare for a just estimate of this both from the standpoint of the specialist and of the larger world. Yet these estimates are also changing; and this not only during life, nor at its close, but in the world's realisation of its concrete legacy, its absorption of less material influence and impulse.

Towards some such regularising of biographies, towards orderly description and comparative treatment, the lives of men of science, of inventors and artists also, since all in their way are so plainly children of a larger growth, lend themselves more easily than do those spent in the complex struggles of the temporal or the spiritual world. Yet where such comparatively clear and simple lives also are plainly affected by the greater streams of thought and of events, and in turn react towards these, we have biographies of peculiar instructiveness, since our inquiries into individual and social evolution must peculiarly unite. Such lives are still rare; for the man of science must more naturally be found

among the cloistered regulars rather than in the busy secular world. Hence a peculiar interest in such a life as that of Reclus. That school of thought which most insists on deriving all things from the geographical *milieu* has here the man whose essential distinction it is to have attained to the universal consciousness of the material world and most to have promoted this. Yet those who explain a personality by its directive ideals, or those who interpret each career as essentially a resultant of the social and political events of its time, will each find a representative man in this young idealist of '48, this veteran of the siege of Paris, this irreconcilable exile from the Commune.

II.

Beginning, then, with the annals of this long and busy life, we are able, thanks to the care and courtesy of his nephew, M. Paul Reclus, to subjoin in colourless presentment that essential outline of facts and dates which his future biographer will thus fortunately find to his hand waiting to be vitalised.[1] Of primary importance towards that reconstruction of the earlier phases of life, upon which our interest and understanding alike so much depend, will be found his brief but admirable recent outline of the life of his much-beloved elder brother and lifelong friend, Elie. So intimate were the two brothers, and despite complemental temperaments and studies, so similar was their early experience, that much of this small biographic sketch may be read at the same time as an autobiographic one, and indeed as one of superior value to autobiography proper, since the writer is without thought of self at all. In this sketch we see a type of home life, which is also one of our own national traditions, for has not the intellectuality and the idealism of Calvinism, its sternness and its strength, culminated in the pastor of the Cevennes, in the Scottish minister of the Covenant or of the Disruption? The schooling of both boys by the Moravian Brothers at their then notable school of Neuwied, where they seem to have been thoroughly grounded in both classical and modern subjects, if disillusionised with its theology, and where they met representatives of many nations, is briefly but vividly told. Here, too, the young Reclus were prepared for their wide interest and sympathy with men of all nations, not only by every form of physical encounter with the representative boy-barbarians of each; or even by the ready assimilation of the leading languages which such a mixed school favoured; but also by forming enduring friendships with Germans, Dutchmen, Englishmen, among whom notably our own George Meredith.

From this school the boys returned to the Protestant College of St. Foy, and in due course to the Theological Faculty of Montauban. But here, in Reclus' own words, "the local influences were singularly overpowered by those which came from the great Paris, bringing the news of political struggles, and then, in a thunderclap, those of the Revolution itself. The year '48, that fine, that generous epoch of

[1] This summary will appear at the end of the paper next month.

which the historic importance will appear greater and greater in coming ages, was already carrying on men's minds towards a new political and social ideal. A Dionysiac intoxication had seized the young, and naturally the students were among the most ardent of all."

After these sentences, so expressive of Reclus' essential standpoint throughout his long and busy after-life, we need not be surprised at the event of next year, a sudden boyish impulse of truancy which sent off the two brothers and a comrade in search of the Mediterranean and its breath of liberty. Weeks afterwards they trudged back, but expulsion followed; and Elisée thence went to Berlin, where the great tradition of Humboldt, the admirable and vivid teaching of Ritter, rapidly shaped him for his scientific work in life. Nothing too can have been more fully complemental to this than the joyous homeward tramp of the two brothers from Strasburg to their southern home, no more perfect preparation for the geographer who was destined most fully to infuse his faithful descriptive science with an ever-youthful joy of nature, and a no less enduring sympathy with the toil of man. This brief idyll ended, the two students arrived at home in time to add their protest against the *Coup d'État* of December 1851, and so to find themselves under the then remorseless ban of the new Empire. Thus began new wander-years; the first spent partly in London, partly in Ireland, and apparently painful at best; but the next two in the United States, both Northern and Southern, which he learned to know in true American fashion, the trained eye of the scientific geographer being sharpened through earning his way and setting his hand to each occupation as it offered itself. Thus schooled and strengthened, three years in South America next gave that first-hand knowledge of tropical nature and agriculture, of Indian and Spanish-American character and civilisation, which were all later to be expressed in living volumes.

But for a Frenchman of all men it is hard to strike enduring roots in foreign lands, so with the amnesty of 1856, proclaimed by Napoleon, now secured in his throne by the successful issue of the Crimean War, the two brothers meet again in Paris, and there begins that steady output of substantial production here recorded year by year. Its main headings show how the juvenile journeys through France, the later stays in the United States and in the tropics especially, bring forth their appropriate fruit, and this not merely in comprehensive descriptive knowledge, but also in matured social thought and intense political conviction. Thus, as the cordial obituary notice in the *Times* (5th July 1905) reminds us, "he was the first French writer to lend support to President Lincoln in the great struggle of the North against the South; so highly was this appreciated that the American Minister offered him a large sum of money, which, as might have been expected, was indignantly refused."

This quiet existence as geographic worker and writer was rudely interrupted by the Franco-German War, the Siege, and the Commune. Of his two ruling passions, that of world-travel and world-vision naturally made him one of that brilliant corps of æronauts whose doings make up an unforgetable chapter in the progress of ærostation: the other

passion, that high inward vision and hope of social ideals, that sympathy with popular aspiration, thence led him into the ranks of the Commune. Of the terrible year he rarely spoke; but the writer was once privileged to hear from his cousin and sister-in-law, Madame Elie Reclus, a description of that time so vivid, so nobly impassioned, that she stands ever since in his memory as the very type and image of the Muse (say rather the Sybil) of History. In his life of Elie above cited,[1] Elisée has briefly and proudly told how his brother earned only his subsequent proscription and banishment by the very greatest service to science and literature possible to man, that of accepting the keepership of the Bibliothèque Nationale throughout that stormy time, and guarding its treasures from dangers on every hand. But we still need the corresponding record of the share of Elisée himself during the Commune, though in a general way this is known to have been also to his credit. Fortunately for science, he was taken prisoner by the Versaillais before the climax of utmost embitterment and the resultant massacres of the vanquished Communards. Removed to Brest, he doubtless thought much, and found expression in giving lessons to his fellow-prisoners. When his turn for trial came in November 1871 he was sentenced to New Caledonia, but an international petition to the Government from men of science, which included the signatures of Darwin, Wallace, and many others, led to the mitigation of the penalty to exile.

III.

Settling at Clarens on the Lake of Geneva, matured in geographical preparation, and with his political hopes destroyed, his social hopes at least indefinitely postponed and now essentially centred upon a general educative process, he was now ready and free to undertake the great work of his life, the *Géographie Universelle*: and to the production of the nineteen bulky volumes of this the next twenty-two years were mainly devoted, up to its completion in 1894.

There are, it is true, estimable specialist workers who affect to undervalue this encyclopædic endeavour, because of this or that inevitable shortcoming in their province, or because of the continuous advance of our detailed knowledge of each of the world's regions. But so also has it not often been a limitation of the workman proper in our time, whether as quarryman or hewer, lumberman or carpenter, to pass beyond legitimate pride in the work of his own hands and to undervalue that of the architect, forgetting that it is through such synthetic skill alone that the product of their labour comes to completion and usefulness?

In the main, however, Reclus' work did not lack the appreciation it deserved; all the more because, as a master of descriptive prose, he raised anew geography into literature, victoriously challenging a higher and keener criticism than that even of his own workfellows in science. To appraise this great work, we must consider it in its place in literature. Adequately to attempt this would involve a muster of kindred great and

[1] *Elie Reclus*, 1827-1894. L'Émancipatrice. (3 Rue Pondichéry), Paris, 1895.

synthetic works of descriptive science from the eighteenth century onwards, and notably from Buffon's *Histoire Naturelle* to Humboldt's *Cosmos*. It would require an analysis of the influence of not a few of the literary masterpieces of three generations, from *Ossian*, from Bernardin's classic *Paul et Virginie*, Rousseau's return to nature, onwards through Chateaubriand's imperishable transcripts of his own experiences in America (*Les Natchez*, *Atala*, etc.), to the idylls of peasant life of Georges Sand, or to the purple prose of Michelet, as much by nature a poet as a historian. Nor could our inquiry remain on French soil alone. Without Ruskin's *Modern Painters*, itself within its limits, as Professor Gregory [1] points out, "one of the finest works in the whole range of geographical literature," our comparison would be incomplete; and here indeed a fresh essay on comparative criticism would be but beginning. Enough, however, if we note here two points. First, that each science in turn needs to be raised into literature, and this even for its own sake as well as for the world's; so that Huxley or Geikie in their popular writings on natural science, or in more abstract fields, William James or Herbert Spencer, with their minor books or essays, are no less truly advancing science than with their technical works, such writing being not merely "popular," but architectonic. Secondly, we may also note that, while each generation must naturally renew its surveys of science for itself, circumstances may give this or that world-survey a peculiar permanence. This is doubly the case for the great work we are discussing, and indeed for all its best contemporaries: for we must not forget that the intense Nature-passion, so characteristic of all the eighteenth and nineteenth century romantics, from Ossian and Rousseau to Ruskin and Reclus, began with the encroachment of the industrial revolution upon the beauty of nature, and culminated with the vast and reckless destruction of natural and historic beauty by the railway and manufacturing age. In these men's youth nature was still to be seen in virginal loveliness, pure from snow to sea, and cities still enthroned upon their past, each unique in its homely or its monumental beauty, since in either case the cumulative museum and treasure-house of the ages. They lived to see all these more ignorantly, ruthlessly demolished or transformed than ever by the desolation of past conquests, the wilful wreckage of ancient wars. Hence their descriptions are so strongly coloured; hence they range from passion to pathos, joy to despair; but we must read them to know the Alps before they became funicular hotel-playgrounds. Hence Ruskin's bitter lament over the polluted Wandel is matched by Reclus' last and briefest description of the prosperous Rhine. Yet that Reclus had no undue fear of change, was no enemy to progress, surely needs no assertion here: his book is not only in great part a record of the conquest of nature by man, but a continual incitement to this. But enough here of its various excellences; each lover of geography may best find them for himself.

---

[1] J. W. Gregory, *The Teaching of Geography*. Melbourne (no date).

IV.

Of his later years at Paris, and since 1894 at the Université Nouvelle of Brussels, happy and fertile though these were; of his manifold productivity, his minor journeys and lecturings—as once and again, 1893, 1895, at the Edinburgh Summer Meeting—there is no space to speak; yet perhaps as little need, for few men can be more warmly remembered, as teacher, colleague, or friend. So here we might leave our author, as his many appreciators have commonly done, or at most call for the perpetuation of his nobly sculpturesque features by some worthy master of the art so greatly renewed among his countrymen. His monument will doubtless soon stand beside that of his cousin Broca in his native town. Yet were our biographic sketch to close here, it would still be incomplete; nay, lacking in essentials. For we do not understand either the man or his work if we forget his full conception of his science, his greatest scheme for its expression and exposition, or with the kindly *Times* writer already cited, treat his social convictions, impracticable or extreme though they may seem to us, as but the expression of his human sympathy, and not also as a thought-out creed. To each of these three points, therefore, some brief consideration must be given.

(*To be concluded.*)

GEOGRAPHICAL NOTES.

Asia.

The New Province of Bengal.—The official resolution, announcing the creation of the new province of *Eastern Bengal and Assam*, has appeared in India. The new province consists of the districts of the Chittagong and Dacca divisions, those of the Rajshashi division except Darjeeling, and the district of Malda. The line of demarcation will follow the present boundaries of these districts. The new province is to be a Lieutenant-Governorship, and the capital is Dacca, the ancient capital of Bengal. The change reduces the population of Bengal proper to 54½ millions, and the territory to 141,580 square miles. Eastern Bengal and Assam will have a total population of 31 millions, and an area of 106,540 square miles.

America.

Exploration of Labrador.—Sir William Macgregor, Governor of Newfoundland, has been lately engaged in a journey of exploration off Labrador. The party started from St. John's on board the *Fiona*, and, in addition to Sir William Macgregor, included Mr. Henry Reeve, C.M.G., who has held office as Director of Public Works in various parts of the Empire; Captain Elgee, a student of anthropology and ethnology; and Mr. Clemenson, a West African official now on leave

of absence, who has previously had experience in survey work under Sir William Macgregor.

On arriving off Labrador the *Fiona* was expected to join forces both with the surveying steamer *Elinor*, and with Dr. Grenfell on board the mission ship *Strathcona*. It is also expected that H.M.S. *Scylla* will take part in the coast survey. Elaborate preparations have been made to secure accurate astronomical observations for the purpose of fixing not only the latitude, but the longitude of various points along the coast. The local supply of instruments has been supplemented by three chronometers and two theodolites, lent by the British Government, while another chronometer and another theodolite have been lent to Sir William Macgregor by the Royal Geographical Society. The expedition will first of all make for Chateau Bay, where there is the most easterly telegraph station in Canada. Here time signals will be received from the observatory at Montreal, and the longitude of the station determined with great exactness. Having thus laid its cartographical work on a sound basis, the expedition will proceed to the northern extremity of the Labrador coast, Cape Chidley, and will thence follow the shore-line southwards, surveying as it goes and fixing the position of various points astronomically. The flow of the tides will also be studied, and other hydrographical work pursued, which should be of material assistance to the fishermen who frequent these waters. Inland the geology, fauna, and flora of the Labrador coast will be the subject of careful investigation, while the physical, mental, moral, and religious characteristics of the native inhabitants will also come under observation. Dr. Grenfell reports that lofty mountain ranges fringe the northern stretches of the coast, and among these ranges and elsewhere it is anticipated, from what is known of the geological formation of Labrador, that valuable mineral deposits may possibly be located.

Expedition to the Western Sierra Madre Mountains.—A geographical and geological expedition to the Western Sierra Madre Mountains of Mexico was recently organised by Colonel W. C. Greene, and an account of the exploration of the northern part of the region is given by Mr. E. O. Hovey in two numbers of *Science* (Nos. 537 and 545). The exploring party consisted of this gentleman, together with Messrs. R. Hill, John Seward, and F. H. Fayant, and left New York on February 4 of the present year. The party was delayed at El Paso by news of heavy snowfall in the mountains, and the interval was utilised to make a trip across the arid region along the Mexican boundary as far as Naco, Arizona, and thence to Cananea, Soñora. The route followed, that of the El Paso and South-Western Railway, gives an excellent section of the mesa and terraces bordering the Rio Grande. The railway also traverses several "bolsens" or pocket deserts, with the accompanying phenomena of volcanic cones and flows of basalt. In these bolsens occur underground water-courses, and therefore abundant water can be obtained in them by means of comparatively shallow wells.

On Tuesday, February 14, the final start was made from El Paso by the Rio Grande, Sierra Madre, and Pacific Railway to the present railhead

at Nuevas Casas Grandes. Fifteen miles from El Paso the road reaches the top of the mesa, and thence onward excellent studies were made and photographs taken of the vast llanos, the peculiar moving sandhills known as "los Medanos," the lost mountains, and the remarkable shallow lagunas, or periodical lakes without outlet, which receive the drainage from the Sierra Madre summits and form the settling-pans for the wind- and water-driven débris from the disintegrating mountains. From Lake Guzman, the largest of these lagunas, the route of the party ascended the San Miguel river, first through wide basin-like valleys, then through deep, tortuous cañons, until finally the head-waters were reached on the undulating plains of the great Sierra Madre plateau, more than 7000 feet above the sea and 3000 feet above the arid plateau containing Lake Guzman.

From the terminus of the railway at Nuevas Casas Grandes the southward journey was made on horseback and with pack train. The remarkable igneous phenomena of the region traversed have been carefully studied, and photographs have been taken of the physiography, geology, and vegetation of the region.

After leaving the cañon of the San Miguel river the journey lay across the high plateau about fifty miles to the north of the new town of Dedrick, which meantime consists of one habitable log hut, and several others in process of construction, standing in the midst of a forest of long-leafed pines, characteristic of the peaks and plateaus from 7000 to 8000 feet in elevation. Immediately to the west of Dedrick the plateau is scored by the great cañon of the Yaqui river, here known as the Aros. This cañon is ten miles wide, and nearly a mile deep, and rivals in grandeur the famous cañon of the Colorado. The cañon has proved of great physiographic and geological interest, and the members of the expedition propose to discuss its characteristics in special papers. The region is also interesting on account of the number of cliff dwellings of prehistoric peoples found in it.

The expedition subsequently climbed out of the Yaqui cañon up to the great mesa out of which the mountains of this region have for the greater part been carved. The vegetation shows great differences in the gorges of the cañons as compared with the mesa, for whereas in the former fan-leaved palms flourish, on the mesa the long-leafed sugar-pine predominates. The course was continued for sixty or seventy miles along the broad plains and narrow divides forming the mesa, and the Tutuaca cañon, which is tributary to the Yaqui, was studied. The western rim of this cañon is near the important Dolores mining district. From this region the journey was continued to Ocampo, Miñaca, Chihuahua, whence the return was made to El Paso, thus completing the circuit. Though the actual mileage of the expedition was not very great, it is stated that the results are of importance, and the problems of buried mountains, bolsen deserts, mesas, and the structure of the Western Sierra Madres have at least had much light thrown upon them.

The Bermuda Islands.—Those who are interested in regional surveys, and the problems of oceanography, should note two articles in

the March and April issues of the *Popular Science Monthly* by Professor Edward Mark on the Bermuda Islands and the Bermuda Biological Station for Research. The articles give a general account of the islands, and are most profusely illustrated with beautiful photographs of the scenery and of characteristic marine animals. Those who have dredged and collected in our own poorer seas will read with envy Professor Mark's descriptions of the wealth of gorgeously coloured organisms to be found round the shores of the islands. The Bermuda Government has decided to erect a permanent aquarium and station at the Flatts, in place of the temporary building now in use, and it is expected that when the buildings are completed they will be open for research purposes throughout the year.

The Sandhill Region of Nebraska.—In *Science* for May 19, Mr. R. H. Wolcott gives some account of a regional survey of this district which is in process of being carried out. The state is an interesting one, for it shows a great range of variation in altitude, (810-5300 feet), and much variation also in soil, climate, and vegetation. Along the Missouri river, which forms the eastern boundary of the state, there is a growth of purely deciduous trees, including walnut, oaks, hickories, butternuts, cherry tree, etc., while spreading into the state from the north and west is a growth of pine, with quaking aspen, balsam poplar, mountain maple, and black birch. Midway across the state, and at an average altitude of 3000 feet, lies a region of sandhills, which range up to 250 feet in height, and are placed very close together. In the sandhill region proper there are no trees of any kind, only stunted bushes of sand cherry, rose, Ceanothus, plum, and June berry. The sandhill region extends over about 11,000 square miles—that is, about one-fifth of the total area of the state. To the north and west of it extend plains cut into by pine-clad cañons, while out of it to the east and south flow streams. These streams have built up valleys into which extend fringes of low trees and shrubs, the advance guard of the vegetation of the south-east. In this sandhill region the Government has recently set aside two large tracts of land as forest reserves. The intention is to plant pines on the hills and deciduous trees in the valleys, in the hope of proving the possibility of afforesting the whole region. If the experiment be at all successful it will be of extreme interest to note the changes simultaneously produced in the fauna of the region, no less than in the minor types of vegetation. The object of the investigation now going on is to make so careful a study of the existing conditions that the changes can be intelligently followed step by step as they occur.

The sandhill region is further interesting for the number of bodies of water, ranging from mere pools to lakes, mostly fed by subterranean streams, and devoid of outlet. Some of these contain absolutely clear and fresh water, while others are strongly alkaline. It is proposed to make also a careful study of the fauna and flora of these bodies of water, with special reference to the variation of the same organisms in different conditions of alkalinity.

Australasia.

The Barclay-Macpherson Expedition.—We have received from Mr. Thomas Reed, Secretary of the South Australian Branch of the Royal Geographical Society of Australia, a newspaper cutting giving an account of a lecture delivered before the Society at Adelaide by Captain Barclay. Captain Barclay was one of the members of the Barclay-Macpherson Expedition, which recently returned from an exploring trip north of Lake Eyre. In his lecture Captain Barclay said the objects of the expedition had been (1) to explore the country and endeavour to find a stock route from Mandoora to Queensland, and in this they were only partly successful; (2) to make a survey of a square mile of country in the sandhills for scientific purposes, which was done; and (3) to search for possible traces of the explorer Leichhardt and his companions, in which object, however, they had not the slightest success. The members of the expedition started out at their own expense, but the Government lent the use of six camels. These they loaded up at Oodnadatta, each animal carrying a load of 6 cwt. The lecturer then traced the course taken by the expedition, and a number of pictures of the scenery *en route* were also exhibited. These proved of the utmost interest, many of them being the first views ever taken of that portion of the continent. Among them are photographs of the huge sandhills, which are traversed by valleys through which the explorers were compelled to travel. The lecturer explained that there are endless tracts of sandhill country consisting of hopeless, lifeless desert, the only vegetation being spinifex. It was a dreary journey, with water scarce and scanty. For eight days at a stretch nothing but sandhills was seen on either side. A splendid picture was given of the Anacoola bore, which struck water at a depth of nearly a quarter of a mile, and has a discharge of 700,000 gallons per day. This water has a temperature of 135 degrees. As illustrating the thirsty nature of the soil, or rather sand, it was found that, in spite of this magnificent flow, there is only a small pond of water in the vicinity; the rest is soaked up by the greedy earth. Captain Barclay noted as a singular fact that bulrushes spring up round all these artesian bores, though where the seed comes from is a mystery, as there is no other vegetation but the eternal spinifex. Views were also shown of the Bonython range of mountains (so named after the president of the society), and of the Todd river. In some portions of the country in the neighbourhood of the Todd river rabbits were found to be very numerous, having infested the country during the last six years. These animals provided ample food for the natives, and the explorors were very glad of their presence to replenish their larder. The party in its eastward journey struck across to the Hale River, where a depôt of provisions was left. They travelled further eastward, but were compelled to retrace their steps for want of water. On the return journey to the vicinity of the Anacoola bore they had to abandon all superfluous luggage and travel with the bare necessities of life, and when they reached water they had only half a gallon of the precious fluid left. The temperature was 114° in the

shade during that terrible journey back, and the thermometer never went below 90° day or night.

The Snowy Range of New South Wales.—At a recent meeting of the Geological Society of Washington, Mr. W. Lindgren read a paper on this subject. He pointed out that it is a familiar fact that the Australian Cordillera follows the eastern coast of the continent until, in Victoria, it bends westward and finally dies out. The highest points of the Cordillera are situated in the southern part of New South Wales, not far from the Victorian boundary-line, and somewhat exceed 7000 feet in elevation, the culminating point being Mount Kosciusko, which attains 7300 feet. The Snowy Range, which includes most of this elevated district, constitutes the watershed between the interior drainage of the Murrumbidgee and Murray Rivers and that of the Snowy River, which empties itself into the ocean in Victoria near the boundary-line between that state and New South Wales.

The plateau sustains a very scanty vegetation of dwarfed eucalyptus. The climate is very cold, the temperature sinking to −20° F. in the winter, and the snowfall is very heavy. The rocks consist chiefly of the rather closely-folded Palæozoic sediments which occupy so much space in the Cordillera. Their age ranges from Ordovician to early Carboniferous, and tuff and intrusive granitic rocks of various kinds are associated with the sediments.

An examination of the Snowy Range, so-called, shows that it is not really a range at all, but a plateau of comparatively gentle relief, a peneplain, in fact, with elevation ranging from 5000 to 7000 feet, in which the Tumut, Murrumbidgee, and Ecumbene Rivers have cut abrupt cañons, the depth of which in some cases amounts to 3000 feet. That this uplift is of comparatively recent age is proved by the basaltic flows which, near Kiandra, cover the summit of the plateau. The basalt covers an old auriferous river channel, which has been traced for twenty miles by means of mining operations, and which has a gentle northward grade. Sand, clay, and lignite cover the thin stratum of auriferous gravel to a depth of 150 feet, and capping this the basalt flow attains a thickness of about 100 feet.

The South-Western Pacific.—At a recent meeting of the Royal Society of Edinburgh, Sir John Murray, K.C.B., read a paper on "The Bathymetry, Deposits and Temperature of the South-Western Pacific."

The region dealt with in the paper extends from the Equator to lat. 48° S., and from the coasts of Australia and New Guinea to long. 165° W., covering an area of about eleven million square miles. About 3000 soundings have been recorded within this region in depths exceeding 100 fathoms, of which nearly one-half exceed 1000 fathoms in depth, and these soundings furnished the material for preparing a depth map, which was exhibited at the meeting. Seven of the soundings were taken in depths exceeding 4000 fathoms, and three in depths exceeding 5000 fathoms, the deepest being 5155 fathoms, or 30,930 feet. If Mount Everest (now acknowledged to be the highest mountain

in the world) were placed in the position of this sounding, its summit would be submerged to the extent of nearly 2000 feet. These great depths were found in what has been called the Aldrich Deep, the term "deep" being applied to all those portions of the ocean-floor covered by more than 3000 fathoms of water, of which there are seven within this region. Only one sounding exceeding in depth those above quoted has up to the present time been taken, viz. in the North Pacific, near the Ladrone Islands, where the U.S.S. *Nero* recorded a depth of 5269 fathoms. The greater portion of the region is covered by more than 2000 fathoms of water, while depths of less than 1000 fathoms occur off the shores of Australia, New Zealand, and the other islands within the region, and on the various ridges and banks revealed by the soundings. The very numerous observations of the water from the surface to the bottom, which have been recorded within the region under consideration, were discussed, and several temperature sections across the region in different latitudes were shown, as well as a map giving the temperature at the bottom throughout the region. This map also brings out the relation between the depth of water and the temperature. Generally speaking, the temperature is very low where the water is very deep. Proceeding to speak of the deposits, Sir John said that the information derived from a study of over 1000 samples showed that globigerina ooze covered about 48 per cent., and red clay about 44 per cent., of the region, the remainder being covered by other deposits. The percentage of carbonate of lime in the deposits covering the floor of the ocean in this region was shown on another map, and here, again, a direct relation to the depth of water might be traced. In very deep water, where the bottom is covered by red clay and radiolarian ooze, and in shallow water off the shores of the islands not bordered by coral reefs, where the deposits are blue mud and volcanic mud, the percentage of calcium carbonate is low. In moderately deep water, where the bottom is covered by globigerina and pteropod oozes, and in shallow water off the coral reefs and islands, where the deposit is coral mud, the percentage of carbonate of lime is high. The great mass of carbonate of lime in these deposits was secreted in water at a high temperature at the surface, though deposited in cold water at the bottom. In conclusion, Sir John Murray said that he believed that the evidence derived from the study of deposits and depths of the region points to the probability that it represented rather a continent in the making than a sunken continent.

Polar.

Peary's Arctic Expedition.—Commander Peary sailed from New York on July 16, and from Sydney on July 26, in his new vessel the *Roosevelt*. The ship carries a wireless telegraphic outfit, which, with one or two relay stations in Greenland, will, it is expected, keep her in communication with the permanent telegraph station at Chateau Bay, Labrador, and thence by existing lines with New York. By the same means communication with the explorer will be possible, at least for a portion of the distance, when in February next the sledge party leaves

the *Roosevelt* for the northern dash. The ship carries two years' supplies. With regard to the route to be followed, it is intended to establish a permanent sub-base at Cape Sabine, on the west coast of Smith's Sound, and, after securing the services of the necessary Eskimos, to force the vessel through Kane Basin and Kennedy and Robeson Channels to the northern coast of Grant Land or of Greenland, if the conditions should compel it, and there winter within 500 miles of the Pole. From these winter quarters a start north over the Polar pack will be made in February. The explorers will have available a probable period of five months in which to traverse the distance between their vessel and the Pole. In the event of the failure of the *Roosevelt* to force Kennedy and Robeson Channels during the first summer, the dash for the Pole would have to be postponed until February 1907. But it is pointed out that the journey to Cape Sabine presents no particular difficulty, and it is reasonable to hope that the further 350 miles to the proposed winter quarters can be made during the first summer. The advantages claimed for this route are that Peary's fixed land base will be 100 miles nearer the Pole than on any other route, that a more rigid ice-pack extending Poleward is to be found than on the other side of the Pole, and that there is a richer land-base to which to return and a well-known line of communication and retreat from the ship to comparatively low latitudes.

General.

Scottish Meteorological Society.—The half-yearly general meeting of the Scottish Meteorological Society was held on July 18 in 5 St. Andrew Square, Edinburgh—Lord M'Laren (vice-president) in the chair.

The report from the Council stated that there had been no change in the Society's stations since the meeting in March. The Registrar-General for Scotland had been regularly supplied with the monthly and quarterly reports from the office, and also direct from the observers in the eight large towns of Scotland, with the daily observations of temperature and rainfall required for his weekly reports. The Meteorological Council at London had been supplied direct from the observers at Glencarron, Fort-Augustus, Braemar, Clathick, Marchmont, and Cally, with daily observations of temperature and rainfall, and in some cases sunshine, for their weekly weather reports. As stated in the report to the meeting in March last, the Ben Nevis and Fort-William Observatories were closed in October 1904. The buildings on Ben Nevis, and the bridle-path which extends from the foot of the hill to the summit, have now been handed over to the proprietor of the ground, in accordance with the stipulation in the feu-charter, by which, when the building ceased to be used as an observatory, the ground and all buildings on it revert to the superior. The observatory in Fort-William has been advertised for sale, but has not yet found a purchaser. As soon as the Fort-William Observatory is sold, the observatories' funds will be wound up and the board of directors dissolved. The closing of the Ben Nevis Observatories, and the dissolution of the Board of Directors, can only

be regarded as a great blow to meteorological investigation in Scotland. The important work of discussing and utilising the Ben Nevis records will now devolve on this Society. The Society has no funds available for this purpose, but certain charges in connection with the examination and discussion of the Ben Nevis observations, which were formerly paid by the Ben Nevis Observatories' Fund, have, since 31st December last, been borne by the Society. During these six months the Society has received special donations from gentlemen interested in the continuance of the discussion of the Ben Nevis records, which have enabled it to meet this additional outlay. Intimation has also been received that for the ensuing academic year 1905-1906 a sum of £108 will be granted for this object to Dr. Buchan by the Carnegie Trust for the endowment of post-graduate research. But more will be needed if the Ben Nevis record is to be fully utilised. The third volume of the Ben Nevis observations, containing the records for the years 1893 to 1897 inclusive, is approaching completion.

Sir John Murray subsequently spoke on the closing of the Ben Nevis Observatories. He said that they very much regretted that the Observatory was closed. He thought it should never have been closed. He did not know one single practical meteorologist to whom he had spoken —and he had spoken to a very large number—who did not regret that the Observatory had been closed; and there was a hope, a very great hope, expressed that some day it might be reopened. But the point, so far as the Society was concerned, was that they now had for a whole meteorological cycle made most valuable observations on the top and at the bottom of Ben Nevis, and it would not do to allow those observations to remain in fallow. They must have these observations discussed and worked up as soon as possible, and it was necessary that the Society, when the Ben Nevis Board of Directors was dissolved, should undertake that work. The Society would have to raise money in order to provide some £300 or £400 a year for four years in order to make these observations speak to convince the world that those who originated the Ben Nevis Observatories were not mistaken as to their scientific value not only for forecasting but for general meteorology.

Sir John's remarks were followed by a paper by Mr. R. C. Mossman on "Some Meteorological Results of the Scottish National Antarctic Expedition," which was illustrated by lantern slides.

NEW BOOKS.

EUROPE.

Russia. By Sir Donald Mackenzie Wallace, K.C.I.E., K.C.V.O. 2 vols. Pp. 456 and 487. London: Cassell and Co., 1905. *Price* 24*s. net.*

The first edition of this standard work was published in 1877, and was the result of the author's residence in Russia during six years (1870-1875). Since then he has spent two years in the European and Central-Asian provinces of Russia; and altogether he claims to have studied his subject for the past thirty-five years. His intention was to have written an entirely new work on "Russia in the Twentieth century"; but he found that, as he could not explain the present without constant

reference to the past condition of Russia, he had better re-issue his original work, revised, re-set, and in great part re-written. This is the work before us, which is accompanied by a fine portrait of the author and two maps, one showing the density of population throughout European Russia, which varies from above 50 inhabitants to the square verst (0·44 sq. mile), as in the district embracing Moscow, Tula, Kharkov, Kiev, and Odessa, and also in Poland, to less than 2½ inhabitants in Lapland and the Samoyede country. The other map shows the four zones of vegetation traversing Russia from west to east.

The work opens by reminding us that during the last half-century the Russian Empire has been covered by a vast network of railways, enabling travelling to be made easily and comfortably throughout it; indeed, he remarks that on the Russian main lines railway "carriages are decidedly better than in England." During the Crimean War Russia had only 750 miles of railway; now she has over 36,000, and every year new lines will be constructed. As "Russia is not a country of fine scenery," and as the "thermometer often descends to 30° below zero," tourists are sometimes disappointed, but the ethnologist will be rewarded if he attends the fair at Nizhni Novgorod in September, for he will there find a "motley and picturesque but decidedly unsavoury cargo" on the Volga steamers, of Finns, Tartars, Armenians, Circassians, Persians, Bokhariots, and other Orientals. Cleanliness is still a rare commodity in Russia, but good hotels may be found in St. Petersburg, Moscow, and Odessa. Roads are still in a disgraceful condition, and any traveller using them "should possess a well-knit muscular frame," for he will certainly have to "rough it."

With regard to the far-famed linguistic accomplishment of Russians, the author says tersely, "the peasants know no language but their own, and it is with the peasantry that one comes in contact." He adds that "the Russian language is one of those things which can only be acquired by practice." Russian peasants have a marvellous power of bearing extreme heat as well as extreme cold. They live chiefly on sour cabbage, cucumbers, and a kind of small beer made from black bread. Although the Russian priests have less learning, culture, and refinement than the Roman Catholic priesthood, they have infinitely less fanaticism, spiritual pride, and intolerance towards adherents of other faiths. The "peasantry regard religion as a mass of ceremonies which have a magical rather than a spiritual significance. They are generally profoundly ignorant of religious doctrine, and know little or nothing of Holy Writ."

"The *Mir* is the most peculiar of Russian institutions." Many years ago Russian philosophers assured the author that England was agriculturally and industrially doomed, and that Russia would be saved by the *Mir*, or rural commune, which owns the land in the vicinity of every village, and distributes it periodically among the members in such a way that every able-bodied peasant possesses a share sufficient, or nearly sufficient, for his maintenance. The *Mir* pays into the Imperial Treasury a fixed yearly sum according to the number of its members. It holds its meetings in the open air, and the discussions are occasionally very animated, but, as no class of men in the world are more good-natured and pacific than the Russian peasantry, the disputants never come to blows. The Village Elder is the "speaker" of the assembly. In the Northern provinces women represent their dead or absent husbands, but have little influence. The assembly discusses all matters affecting the communal welfare, and even fixes the time for making hay and when ploughing should commence, and the will of the *Mir* is absolute.

Russian merchants as a class have two great blemishes—their ignorance and dishonesty. Many of them can neither read nor write. The old race of British

merchants in Russia is rapidly dying out, and German merchants, who have generally a much better commercial education, and have a better acquaintance with Russia, will, the author thinks, ultimately expel their British rivals.

Although there is in Russia "a curious world of heretics and dissenters," the great majority of the population belongs to the Russian Orthodox Church, which has exercised a powerful influence in the formation of the national character. The Czar, acting through the Holy Synod appointed by him, is "the supreme defender and preserver of the dogmas of the dominant faith." Russian ecclesiastics are all most loyal subjects and warm adherents of autocracy. The higher ecclesiastical administration has always been in the hands of the monks, or "Black Clergy," who form a large and influential class. Government does not permit the press to discuss religious questions; and Russian ecclesiastical literature is all historical, homiletic, or devotional. With regard to the movement a few years ago for a possible union of the Russian and Anglican Churches, the author considers a real union would be "as difficult of realisation, and as undesirable, as a union of the Russian Council of State and the British House of Commons."

The Russian Noblesse is not a caste like the German "Adel," "but takes rather the English aristocracy as its model, and harbours the secret hope of one day obtaining a social and political position similar to that of the nobility and gentry of England." Titles are very common in Russia, and there are hundreds of Princes and Princesses who have not the right to appear in Court, and who would not be admitted into refined society in any country. The majority of Russian nobles are poor, and there is very little aristocratic sentiment either in them or in the Russian people. Yet "class distinctions form one of the most prominent characteristics of Russian society"; the French-speaking noble, the bearded merchant in black cloth cap, the priest with uncut hair and flowing robes, and the peasant in his greasy sheepskin, being everywhere well-marked types. At the same time, we find in the history of Russia almost no trace of those class-hatreds which appear so conspicuously in the history of Western Europe, and there is very little caste spirit or prejudice in Russia at the present day.

Owing to the "kindly *bonhomie* which distinguishes the Russian educated classes," the author was able to study the administration of Russia. Officials willingly assisted him; and while he believes that the majority of the governors of provinces are honest, upright men, he admits that "Russia has had to suffer much from the jobbery, venality, and extortion of the officials." The Emperor is, of course, supreme, and may at any moment override the Law by means of what is called a "Supreme Command," and a minister may interpret a law in any way he pleases by means of a circular. The expansion of Russia has been due to colonisation, self-defence against nomadic tribes, the desire to reach the sea-coast, and anxiety to acquire new markets for her manufactured goods. In 1897 the Russian Empire consisted of over two million English square miles in Europe and over six in Asia, with a total population which had grown from 14 millions in 1722 to 129 millions in 1897.

To many readers of this work the last chapter, entitled "The Present Situation," will be the most interesting. Is the reign of the present Czar to be a repetition of that of his grandfather, or is Russia about to enter on an entirely new phase of her political development? The author replies: "As soon as the Autocratic Power has decided on a definite line of action, it is to be hoped that a strong man will be found to take the direction of affairs." He shows us the various political groups at present struggling to effect reforms, and analyses the Opposition to Autocracy, which consists of three sections:—(1) The Liberals, who, in his opinion, are the most numerous and the best prepared to undertake the functions

and responsibilities of government. They represent the educated classes, who have come to be possessed of an ardent desire for genuine parliamentary institutions on a broad democratic basis. (2) The Social Democrats, who propagate the belief that the Autocratic Power is the ally of the capitalists and hostile to the claims and aspirations of the working classes. (3) The Socialist Revolutionaries, who hope, chiefly by agrarian disturbances, to overthrow the Autocratic Power and bring about the great economic and social revolution to which the political revolution would be merely the prologue. They are endeavouring to enlist the aid of the peasants by maintaining that all the land belongs to the peasants, and, by inciting the latter to rise against the landed proprietors, they hope to create a vast Revolution, which will make Autocratic government impossible and Socialism triumphant.

Cities and Sights of Spain: A Handbook for Tourists. By Mrs. Aubury Le Blond (Mrs. Main), with numerous Illustrations from Photographs by the Author. Pp. 214. London: George Bell and Sons, 1904.

This is a reissue of a well-known little book first published in 1899, and reviewed in these columns on its first appearance (see vol. xvi. p. 54). The present edition has been revised, and contains a note on the Total Eclipse which took place in August of the present year.

Our English Home. By C. W. Crook and W. H. Weston. ("Round the World Series.") *Price* 6*d.* London and Edinburgh: T. C. and E. C. Jack.

A copiously illustrated little book which gives in simple language a large amount of information in regard to England. The numerous simple maps are very clear and suggestive.

Illustrated Handbook to the Perthshire Natural History Museum, and Brief Guide to the Plants and Animals of the County. By Alex. M. Rodger, Curator. Perth: Published by the Museum Joint Committee at the Perthshire Natural History Museum. *Price* 3*d.*

This modest little handbook marks a new departure in the history of that most useful institution, the Perthshire Natural History Museum. The museum is probably known to the majority of our readers as the model of what a local museum should be, and the handbook is admirably adapted to make its value more generally appreciated. In addition to lists of the specimens displayed, with notes and sketches, each section has references to books on the subject treated, the references applying only to works in the library of the Perthshire Society of Natural Science. As the Curator points out, these references afford a convenient means of showing the groups which have been well worked out; and those which still require additional attention. To the geographer, no less than to the naturalist in the wide sense, the pamphlet will be found most useful.

ASIA.

En Zigzag de Singapour à Moscou. Par Jean de Nettancourt-Vaubecourt. Pp. 320. *Price* 3 *fr.* 50. Paris: Plon, 1905.

As the author does not disclose the date of his tour, he deprives his readers of considerable interest in it. He passed from Singapore to Java, French Indo-China, Hong Kong, Canton and Macao, and the Yangtse Valley, and finally arrived in Japan. From thence he visited Korea, and proceeding to Pekin, he travelled by railway to Moscow. Of course his tour preceded the present war, so his observations on the Japanese Army show his prescience of its power. A visit to the 2nd

Regiment of Infantry of the Guards at Tokio "left on me," he remarks, "vivid military impressions. Here I found myself in the midst of a people deeply conscious at once of its martial traditions and its modern political responsibilities." He was struck with the "nervous precision" with which the soldiers went through their drill, and observes: "The power of concentration of the Yellow Race, which has not yet been enervated like our races by application to too many objects, is most useful to them; and, especially in volley-firing, the precision and coolness of the troops really attained perfection. A French officer called my attention to the silence and unison with which a surprise manœuvre was carried through. In a European barrack-yard there would have been noise and some confusion, but here every one knew his place and silently did his duty."

From Tokyo to Tiflis. By F. A. M'Kenzie. London: Hurst and Blackett, Ltd., 1905. Pp. 340 + x.

These "Uncensored Letters from the War" by the special correspondent of the *Daily Mail* are at once interesting and instructive. They follow the fortunes of Kuroki's army in its triumphant march from the Yalu to Liaoyang, and show how hard was the struggle and severe the experiences of both Russians and Japanese. The life and customs of the Koreans are incidentally touched upon, and much geographical information is given. It is a pity that many of the places named in the accounts of the battles are not to be found in the map; while a great many place-names on the map are not mentioned in the letterpress. A little more care in this particular would have made the descriptions more easily followed. The illustrations, some thirty in all, are interesting and relevant, but they hardly come up to the standard of the writing. A few chapters give a glimpse into the state of Russia itself during the present time of strain; and in the last chapter the author gives a forecast of the probable development of things if Japan should finally triumph all along the line. The book is eminently readable and fair-minded.

AMERICA.

Problems of the Panama Canal. By Brigadier-General Henry L. Abbot, U.S. Army (retired). Pp. 248. New York: The Macmillan Company, 1905.

M. de Lesseps' work on the Panama Canal began in 1881 and closed disastrously in 1888. Thereafter a Commission was appointed and sent delegates to examine the condition of the works of the insolvent company, and a New Panama Canal Company was formed in 1894. General Abbot was a member of this Company's Technical Committee, and ultimately acted as its consulting engineer up to the final transfer of the canal to the United States in 1904. Having been an officer of the United States Army Corps of Engineers, and having devoted about seven years to a technical study of the problem involved in this remarkable canal, which, when constructed, bids fair to revolutionise the maritime conditions of the West, General Abbot speaks with the authority of an expert. An excellent orographic map is given showing the proposed French route of the canal, and the author discusses the rival routes; the physical conditions of the isthmus; the regulation of the Chagres River, "by far the most important element to be considered"; the disposal of rainfall in the basin above Bohio; and the various projects for the Canal. "The dream of M. de Lesseps," he says, "was a canal without locks, but he was a diplomatist, not an engineer, by profession, and the information then existing was wholly insufficient to justify any technical opinion on the matter." Now, however, "it is the unanimous opinion of all the engineers who have had practical experience in canal work, and time to thoroughly

study the problem, that no sea-level *projet* without locks, and no sea-level canal even with a tidal lock, is practicable that would be comparable in ease and safety of transit to one equipped with modern locks, and planned to take advantage of all the desirable elements which the natural conditions offer."

Canadian Life in Town and Country. By HENRY J. MORGAN and LAWRENCE J. BURPEE. London: George Newnes, Ltd. *Price* 3*s.* 6*d.*

To those of our readers who are disinclined to undertake the perusal of more exhaustive works on the subject, or who desire to have merely a sketch of Canada as it is, we can commend this work—the latest, we believe, of the "Our Empire" series, published by George Newnes, Ltd. It contains thirteen chapters, the headings of which fairly indicate the design and scope of the work—*e.g.* Trade and Commerce, Picturesque Canada, Sports and Amusements, etc.—and contrives to give the reader a good deal of information in a condensed but fairly readable form. The writers are naturally enthusiastic with regard to the capabilities and future of their country; but although effusively loyal, they do not hesitate to indicate some of the rocks ahead in the relations of the colony and the mother-country. How important Canada will be to England in the future can be gathered from a quotation, as follows:—"A year or two ago the British Government made inquiries as to the carrying capacity of the Canadian Pacific Railway, with a view to utilising the Canadian route in time of war. The company replied that they were prepared to handle five thousand troops a day, and to carry them across the continent in one hundred hours. When the new transcontinental road is completed a few years hence, England can count on at least double this capacity—a fact which might conceivably have a very vital bearing on a war situation in the Far East. It is only a question of time, too, when the manifest advantages of opening up the Hudson's Bay route will press themselves upon the attention of the public men and capitalists of Canada. There are already a dozen or more railways projected towards Hudson's Bay, from points in the North-West, Manitoba, and Ontario; and a charter has also been granted for a road from Fort Simpson direct to Fort Churchill on the Bay, where an excellent harbour exists. If this should become an accomplished fact, and a line of powerful steamers were established on the route from Fort Churchill to Liverpool, all the existing routes from Europe to the Far East would be left far behind. This route, too, would enable Canada to land grain in Liverpool a couple of days before the same grain could be shipped *via* New York, and she could thus capture the entire grain trade of the West—American as well as Canadian." Not the least useful part of the book is a note which gives "a list of the best and most authoritative works, either by Canadians or others, covering the various topics discussed in *Canadian Life in Town and Country*, including works of reference; general descriptions of the country, its people, its characteristics, its resources, and so forth; histories, books of travel, scientific works, biographies, statistical compilations, collections of folk-lore, and, in fact, everything having a bearing, direct or indirect, upon the wide subject of Canadian life in town and country." We may add that the book is embellished with some good photographs.

AUSTRALASIA.

The Calvert Scientific Exploring Expedition (Australia, 1896). Compiled by J. S. HILL. London: George Philip and Son. *Price* 2*s.*

This is an account of the Calvert Expedition which has been compiled by Mr. Hill from the telegrams and newspaper accounts which appeared in the Australian

press at the time of the expedition. The account includes not only the journey of the main expedition, but also a description of the search for the two missing members, and the finding of the bodies of these two, Mr. C. F. Wells and Mr. G. L. Jones, who died of hardship while on a flying trip away from the main body. A large map shows the route and discoveries of the expedition.

AFRICA.

The Nile in 1904. By Sir William Willcocks, K.C.M.G. London: E. and F. N. Spon, 1904.

This is one of those books which come to the reader with the stamp of authority. The work which Sir William Willcocks has done in connection with the irrigation of the Nile is an assurance that the book which he has just published contains accurate and reliable information concerning the most interesting river both of the ancient world and our own time. Such interest was never greater than at present, when Egypt has permanently come under British government, and has already given evidence that a prosperous future is in store for her.

It is almost impossible to give any idea of the enormous amount of exact information—the result of prolonged and continuous observation—which is contained in the present book. The first two chapters describe the Nile and its tributaries, their catchment basins and discharges, and also the climate and geology of the Nile Valley. The utilisation of the Nile is then dealt with, and another chapter is devoted to future projects. There is also a separate chapter by Mr. H. J. L. Beadnell on the oases and geology of Egypt. A series of appendices of great statistical value contains the results of observation of the Nile over a period of years, maximum and minimum discharges, etc. A series of over twenty plates of plans, diagrams, and sections, illustrates the subject matter.

GENERAL.

L'Expansion des Boers au XIX. Siècle. Par Henri Dehérain. Pp. 433. Paris: Hachette, 1905.

The author states that "this is a book of history, nothing more. The Boer Republics engrossed the attention of the world for three years. The question of the Boer race remains a serious one for the British Government, and an interesting one for every person of culture. In the present volume an attempt is simply made to investigate, by the study of documents, the origin of the Boers." With the aid of eight maps the author conscientiously proceeds with his task, and brings the history of the Boers down to 1854. He also devotes a chapter to "British Colonial Doctrines," in which he points out that Britain had not always been advised to follow an ambitious Colonial policy. "Half a century ago," he says, "many British statesmen, impressed with ideas absolutely opposed to those of to-day, maintained that it was not only fatal for a nation to extend its oversea possessions indefinitely, but that it was even advantageous to restrict them. This theory, which the Imperialists of to-day term 'Little Englandism,' and contemptuously reject in favour of a 'Greater Britain' policy, has had its supporters since the end of the eighteenth century, when Josiah Tucker, Dean of Gloucester, wrote in 1781 a series of letters under the title *Cui Bono?* to Necker, maintaining that its total separation from its American colonies would be the most fortunate thing that could happen to Britain."

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th June 1905:—One-inch Map (third edition, engraved, with hills in brown or black).—Sheets 22, 23. Price 1s. 6d. each. Engraved in outline.—Sheet 23. Price 1s. 6d.

Six-inch Maps Revised full sheets, engraved, without contours. *Ross and Cromarty.*—Sheets 105, 107, 109, 129. Price 2s. 6d. each. Sheets 114 and 121, 127. Price 2s. each.

Quarter Sheets, Heliozincographed, with Contours. Price 1s. each. *Banffshire.*—8 SW.; 29 SW. and SE.). Without contours. *Banffshire.*—34 SE. and 35 SW.; 36 NW.

1 : 2500 Scale Maps (Revised) with Houses ruled, and with Areas. Price 3s. each. *Banffshire.*—Sheets I. 12 (16 and 15); XIII. 1, 2, 4, 5, 9, 13; XVIII. 3, 4, 7, 8, 12, 15, 16; XXIII. 4, 7, 8 (12 and 11), 15; XXIV. 2, 3, 5 and 1, 6. *Elginshire.*—Sheets II. 7 and 6, 11; XIII. 16; XIV. 16; XVI. 6, 7, 8, 11, 12, 16; XVII. 5, 6, 9, 13; XVIII. 4, 8, 12, 15; XIX. 1, 2, 3; XXII. 16; XXIII. 2, 3, 6, 9; XXVI. 3, 7, 10, 11, 13, 14; XXVII. 1; XXX. 8, 10, 11, 12, 14, 15, 16; XXXI. 2, 5, 6, 10. *Inverness-shire.*—Sheets I. 6, 10, 14; IV. 8, 12, 16; XII. 4. *Sutherland.*—Sheets XCV. 9, 14; CIII. 2.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

ASIA.

MANCHURIA.—

1. Map of the Country round Mukden, with hills. Scale 1 : 420,000.
2. Map of the Country north of T'ieh-Ling, with hills. Scale 1 : 420,000.
3. Map of the Country west of Ninguta, with hills. Scale 1 : 420,000.
4. Map of the Country south of Karbin, with hills. Scale 1 : 420,000.
5. Map of the Country round Vladivostock. Scale 1 : 420,000.
6. Map of the Country round Vladivostock. Scale 1 : 630,000.

Reproduced from Russian Staff Maps 1904, 1905. Price 2s. each sheet.

Topographical Section, General Staff, London.

LHASA.—Sketch Plan of Lhasa from the Survey by Capt. C. H. D. Ryder, R.E., and Capt. H. M. Cowie, R.E. 1904. Scale : 4 inches to a mile.

Hurst and Blackett, Ltd., London.

AFRICA.

AFRICA.—General Staff Map on scale of 1 : 1,000,000 or about 16 miles to an inch. District Sheets—7, Tripoli; 8, Ben-Ghazi; 14, Sella; 15, Anjila; 58 and 70, Freetown; 73, Kotonu. 1905. Price 2s. each.

Topographical Section, General Staff, London.

LAGOS.—General Staff Map on scale of 1 : 250,000 or about 4 miles to an inch. Sheets 73-B, 73-F. 1905. Price 1s. 6d. each sheet.

Topographical Section, General Staff, London.

NORTHERN NIGERIA.—General Staff Map on scale of 1 : 250,000 or about 4 miles to an inch. Sheets 50-H, 50-I, 50-K, 50-L, 50-M, 50-O, 50-P. 1905. Price 1s. 6d. each sheet. *Topographical Section, General Staff, London.*

SOUTHERN NIGERIA.—General Staff Map on scale of 1 : 250,000 or about 4 miles to an inch. Sheets 74-I, 74-J, 74-M, 74-N. 1905. Price 1s. 6d. each sheet.
Topographical Section, General Staff, London.

NORTH AMERICA.

CANADA, ONTARIO.—Standard Topographical Map, Hamilton Sheet, 2, SW. Scale 1 : 250,000 or 3·95 miles to an inch. James White, F.R.G.S., Geographer.
Department of the Interior, Ottawa.

CANADA, YUKON TERRITORY.—Kluane, White, and Alsek Rivers. From Surveys by International Boundary Commission, 1893-95, J. M'Arthur, 1900, A. C. Talbot, 1899, and J. B. Tyrell, 1890. Scale 1 : 400,000 or 6·32 miles to an inch. James White, F.R.G.S., Geographer.
Department of the Interior, Ottawa.

CANADA, NOVA SCOTIA.—Geological Survey Sheets, 42, 43, 44, 45, 46, 47, 48, 56, 57. Scale 1 : 63,000 or 1 mile to an inch. Robert Bell, LL.D., F.R.S., Director. Price 10 cents each sheet. *Geological Survey Office, Ottawa.*

CANADA, ONTARIO.—Geological Survey Sheets, 4, 118, 121. Scale 1 : 253,440 or 4 miles to an inch. Robert Bell, LL.D., F.R.S., Director. Price 10 cents each sheet. *Geological Survey Office, Ottawa.*

CANADA, BRITISH COLUMBIA.—West Kootenay Sheet, with contours; Atlin Mining District, Geological. Scale 1 : 253,440 or 4 miles to an inch.
Geological Survey Office, Ottawa.

CANADA, HUDSON BAY.—Geological Map of the east coasts of Hudson Bay and James Bay in District of Ungava and Province of Quebec, to illustrate report by A. P. Low, B.Sc. Scale 1 : 506,880 or 8 miles to an inch. Sheets 1, 2, 3. Price 10 cents each. *Geological Survey Office, Ottawa.*

UNITED STATES SURVEY.—Topographic Sheets on Scale of 1 : 62,500 or about 1 inch to a mile. Price 5 cents each sheet. (The figures indicate the number of sheets received for each State.) California, 1; Colorado, 4; Connecticut, 2; Illinois, 1; Maine, 7; Maryland, 6; Missouri, 4; Montana, 4; New York, 17; North Carolina, 7; Ohio, 6; Pennsylvania, 7; South Carolina, 1; Tennessee, 1; Vermont, 1; West Virginia, 7; Wisconsin, 1; Alaska, 1. *United States Geological Survey, Washington, D.C.*

UNITED STATES SURVEY.—Topographic Sheets on Scale of 1 : 125,000 or half an inch to a mile. Price 5 cents each sheet. (The figures indicate the number of sheets received for each State.) Arizona, 1; California, 2; Colorado, 1; Connecticut, 1; Georgia, 1; Indian Terr., 1; Michigan, 1; Montana, 1; New York, 1; North Dakota, 1; Oregon, 1; Tennessee, 1; Texas, 3; Washington, 2.—Topographic Sheets on Scale of 1 : 250,000 or about quarter of an inch to a mile. Price 5 cents each sheet. California, 1; Colorado, 1.
United States Geological Survey, Washington, D.C.

UNITED STATES AND CANADA.—New Reduced Survey Map of the United States and Part of Canada. By J. G. Bartholomew, F.R.G.S., etc. Scale 1 : 5,000,000 or 79 miles to an inch. With inset maps of New York, Boston, Philadelphia, Chicago, and San Francisco. 1905. One sheet, size 30 × 40 inches. Price 2s. or 3s. mounted on cloth. *John Bartholomew and Co., Edinburgh.*

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ADDRESS TO THE GEOGRAPHICAL SECTION OF THE BRITISH ASSOCIATION, 1905.

By Rear-Admiral Sir W. J. L. Wharton, K.C.B., F.R.S.,
President of the Section.

It is sometimes denied to Geography that she has any right to consider herself as a science, the objection being apparently founded on the view that it is a subject that can be learned by heart, but not studied on any systematic line or reduced to principles which enable advance to be made, as in the more exact sciences, by continual investigation by means of laws discovered in the course of such investigation. This, it appears to me, is a misapprehension due to an incomplete recognition of what Science is, and of what Geography is.

Science is, in its simplest interpretation, "knowledge," such knowledge as comes from an intimate acquaintance with and study of any subject duly co-ordinated and arranged. The subjects which the advancing education and civilisation of the world have caused to be minutely studied are very many, and as knowledge has increased specialisation has become a necessity, until the list of sciences is very long.

Science may be broadly divided into several categories:—

Pure or Exact Science, such as Mathematics; Natural or Physical Science, which rests on observations of Nature; Moral Science, which treats of all mental phenomena.

Some sciences are of ancient foundation, some have arisen from new inquiries and needs of man, or from fissure in subjects too wide for convenient treatment as one.

Many of them are capable of exact definition, and their boundaries and limits can be well marked.

To others no very distinct limitations can be assigned. From their nature they overlap and are overlapped by other subjects, and it is impracticable to confine them by a strict line.

Geography is one of the latter.

Geography is one of the most ancient subjects studied with the view of co-ordinating facts. A desire for exact knowledge of, first, the bearings and distances of one place from another for the purposes of intercommunication must have arisen as soon as men became collected into groups whose growing civilisation and needs required travel to obtain what could not be obtained in the community. This was the earliest form of Geography, and it is an aspect which still remains, and to some is, in the modern shape of maps, the principal, if not the sole, end of Geography.

From the earliest times, however, geographical information included other than topographical data.

It was soon found that for the traveller and statesman, whether in peace or war, more was wanted to enable Geography to supply requirements.

The nature of a country, the supply of food and water, the characters of the rivers, the manners and customs of the inhabitants, their language and affinities, the climate, and other matters, were all of much moment, and Geography dealt with them all, being, as its name denotes, in the broadest sense a "description of the earth."

After the first crude guesses of relative positions, founded on times occupied on journeys, other knowledge was enlisted in the cause.

Astronomy was soon recognised as the only means by which to ascertain the distances of places far apart and separated by seas, but for many centuries this could only be applied to latitude. Still the scientific geographer had to study and use the astronomical and geodetic methods known.

As knowledge increased, the subjects became too wide to be strictly considered as one study, and many have become the objects of special research under different titles.

Geodesy deals with the precise form of the earth and its dimensions.

Geology studies the nature of the materials forming the earth's crust, and the changes in it in past ages.

Ethnology and *Anthropology* treat of the different races of mankind.

The study of *Economics* takes note of the conditions of communities and nations, their laws and systems of government.

Botany and *Zoology* now concern themselves with the details of vegetable and animal life.

Archæology investigates the remains of past civilisations which cover the earth.

Meteorology strives to unravel and reduce to law the complicated conditions of the atmosphere, its continual movements, and the results which have such varying effect on our daily life.

Oceanography, the study of the phenomena of the sea as distinct from the dry land, is still regarded as an integral part of Geography, but is rapidly becoming a subject by itself.

Of all these subjects Geography may be considered to be the parent; and though the family be large and has gone off on many separate lines, it is necessary, when taking a large and comprehensive view of the united results of knowledge thus gained, especially from the point of view of Distribution, to return to that parent and consider them on a general or geographical basis.

I cannot pretend to define Geographical Science in a clearer or shorter form than that in which it has been already put by General Sir Richard Strachey, and I will quote his words:—

"To investigate and delineate the various features of the earth, to study the distribution of land and sea, and their effects upon climate, the configuration and relief of the surface, positions on the globe, and so forth, facts which determine the existent conditions of various parts of the earth, or which indicate former conditions, and to ascertain the relations that exist between those features and all that is observed on the earth."

Strabo, in the opening words of his introduction to his great Geography, puts it thus:—

"If the scientific investigation of any subject be the proper avocation of the philosopher, Geography, the science of which we propose to treat, is certainly entitled to a high place. In addition to its vast importance in regard to social life and the art of government, Geography unfolds to us the celestial phenomena, acquaints us with the occupants of the land and ocean, and the vegetation, fruits, and peculiarities of the various quarters of the earth."

This was written when Geography included all natural science, and before it gave birth to so many separate subjects; but it sets forth so admirably the aims which the geographer still pursues that it is worthy of remembrance.

It is not advocated, nor is it in any way necessary, that all should study Geography in the extended sense thus indicated; but it cannot be too strongly pointed out that an educated man—and education is now essential to the successful conduct of affairs—must have a considerable knowledge of the elementary facts of Geography.

These elementary facts are, it is true, of the nature of a lesson, and must be learnt, so to speak, by heart by the aid of maps and books; but this is nothing more than making use of the labours of others, without which no advance is possible in any subject, and is common to all studies.

We must, in fact, distinguish between the science of Geography, which consists in ascertaining and co-ordinating new facts, and putting them into a shape for the use of others, which is the work of comparatively few; and the practical Geography which consists of making use of that work, and, as in many other branches of science, is within the reach of all who choose to devote time to it.

It is the object and business of the British Association to try to interest their fellow-countrymen in all branches of knowledge, to gain if possible more workers in science, but at any rate to induce all educated persons to take advantage of the solid work done by others towards the elucidation of the details of the glorious Nature which surrounds us on

all sides, and in so many forms, and without which ignorance and superstition, those primary bars to the advancement of mankind, can never be banished.

It is impossible to have a clear comprehension of history, whether past or current, without calling in the aid of Geography; but unfortunately much history has been written and taught without such aid.

To read the daily paper requires either geographical knowledge or constant reference to maps; and if readers would only make a practice of such reference on every occasion when they are at fault, they would soon find themselves acquiring knowledge of the greatest use to them in the easiest and most interesting manner, and with the smallest expenditure of time.

The mistakes made even by those responsible for the conduct of public affairs, by reason of the want of this essential but elementary knowledge, are innumerable, and to this day there are many who consider themselves highly educated and capable men who cannot even rightly understand a map.

As I have before indicated, good maps are the foundation of all sound geographical knowledge, and these maps must be founded on good surveys.

Now a good survey is a comparatively modern operation, and the parts of the world that have been subjected to it are small indeed.

It is true that we now have general maps of the larger parts of the world, which more or less convey a fair representation of the configuration of land and sea when large areas are considered, but details are sadly lacking almost everywhere.

It is not astonishing, for to make the necessary surveys requires an enormous expenditure of both time and money, and the latter is hard to get until the necessity for its expenditure is patent to the smallest intelligence. Thus many countries long settled and in a high state of civilisation are still without any organised system of survey or maps, and even in the United Kingdom it is only from the year 1784 that a proper survey was established of the British Isles, though no maps were published from it until 1801; and it has proceeded so slowly that it has only recently been in one sense completed, while its revision, badly wanted on account of changes, is still in active prosecution, and must be continued *ad infinitum*.

Such indifference is, however, giving way to experience of the results of absence of proper maps, and all who wish well to the progress of South Africa must be pleased at finding that their provision has been taken in hand on such an admirably scientific basis as is provided by the Trigonometrical Survey, now far advanced, and the successful progress of which is, I believe, greatly due to the inexhaustible energy of my friend Sir David Gill, who seems to find time to promote and aid all branches of knowledge, and that steps are now being taken to prosecute the detailed topographical survey and provide good maps.

To many people one map is as good as another. They do not pause to consider on what it is based, or what degree of accuracy it probably possesses, but so long as there is a map they are satisfied.

A vast number of existing maps are compiled from the roughest materials: in partly occupied countries, from drawings of small areas placed together as can best be done, by means of places here and there the relative positions of which are fairly known by distances along roads, with perhaps in some cases angles and astronomical positions; in less civilised parts by routes of travellers laid down by estimation of the distance traversed and direction of march, checked perhaps by a few astronomical observations of more or less value as the traveller possesses or does not possess the necessary skill.

The compilers of such a map have a difficult task. Discrepancies are, of course, multitudinous. Nothing agrees, and one has to accept, reject, and adjust as best he can on his own responsibility and with what knowledge he can procure of the respective trustworthiness of each author.

Happy is he if he has even a few positions in his map which have been properly determined, as between them he is saved from the constantly increasing errors of adding one little area to another, which if carried on indefinitely culminates in great errors.

Of course such maps are of no practical use, save as giving a very general idea of a country, and when required by the administrator or traveller lead to endless mistakes and annoyances.

The feature of our globe which is now, broadly speaking, most accurately laid down is the coastline. The safety of navigation has caused general marine surveys to be carried on all over the world during the nineteenth century, which have finally determined the position and shape of the boundaries of the sea.

These surveys, executed for the most part by skilled naval officers with proper instrumental outfit, and supplied especially with trustworthy chronometers, and based upon frequent carefully determined astronomical positions, have resulted in this boundary line being delineated with an accuracy, so far as its absolute position is concerned, far in advance of any other main feature in maps.

Here I may perhaps explain to those unversed in these matters why this is so.

The position of any spot on the earth's surface can be ascertained in two ways: either by careful measurement by means of an accurate system of triangles from another spot already fixed, or by independent observations of the heavenly bodies and calculations from them, which give the precise latitude and longitude of the place. The former is suitable for positions inland, but entails much time and labour, and is only adopted when a perfect map is to be made, for which it is the indispensable foundation. The latter can be carried on from a ship, and in most circumstances only from a ship, because of the limitations of the methods of determining longitudes.

Longitude can now be satisfactorily and rapidly ascertained in two ways: by the electric telegraph or by use of chronometers.

The places served by the electric telegraph are still few, and its use is therefore restricted; but the chronometer has been in working use for more than a hundred years.

This instrument, which is merely a watch of especial construction,

will only keep a steady rate when it is undisturbed by irregular shocks or motions.

No means have yet been found for transporting a chronometer on land without upsetting its regularity, and therefore rendering it useless; but on board a ship it can be so suspended and stowed as to prevent its being disturbed by any ordinary movements of or in the ship. The accurate time of any place departed from, ascertained by astronomical observations, can therefore be carried about on board ship for considerable periods, and by comparison with the local time, also determined by sextant observations of the heavenly bodies, at any required spot on the coast, the difference of longitude is at once obtained with very small limits of error when a number of chronometers are employed. These two simple yet marvellous instruments, the sextant and the chronometer, have thus placed in the hands of sailors ready means of fixing with great exactitude and celerity the position of selected points on coasts all over the world; and it will be seen that, while the detail of the line of coast between such fixed positions will depend upon the degree of accuracy of the survey or sketch, the general line cannot get far out, as it is constantly checked at the selected points.

It is not claiming too much to say that at the present time very few salient points on the coastlines of the world are as much as two miles in doubt.

It should be a source of great satisfaction to the Briton to know that both these instruments were devised by Englishmen, John Hadley producing the sextant in 1730, in the form still used, on the basis of ideas formulated by Newton fifty years before; and John Harrison the chronometer in 1736. The latter instrument has undergone modifications in detail, but the principle remains the same. It required seventy years before its value was fully recognised and it came into general use.

It is a still further satisfaction to think that it is British naval officers who have made by far the greatest use of them in mapping the coasts of the whole world. Since the time of the great Captain Cook, British surveying vessels have been constantly employed in this work, not only in British colonies, but in all parts, aiding and often paving the way for British commerce, and for the men-of-war that protect it.

It is difficult to find coasts of any extent that have not been laid down by British marine surveyors. The whole of Africa has been their work. By far the greater part of America, all the south and east coasts of Asia, Australia, and most of the innumerable islands in all oceans, have been fixed and laid down by them. Even in the Mediterranean, until very lately, the charts were mostly founded on British surveys, and the improvements now being carried out by other nations on their own coasts in details required for modern navigation do not materially modify the main shapes and positions formerly determined by the British.

It has been, and is, a great work, and I hope I may be pardoned for dwelling on it with pride as the result of the wise administration of the Admiralty for many years, and of the immediate labours of my predecessors as Hydrographer, and as a very great contribution to geographical knowledge, more especially as I do not think that it is generally

realised that this great advance in geographic accuracy is due to marine surveyors.

To give an idea of the comparative accuracy of the chronometer method, I may mention that on taking at hazard eleven places distributed all over the world at great distances from England, the longitudes of which have been recently determined by means of the electric telegraph and elaborate series of observations, I find that the average difference between the chronometer and the telegraph positions is 700 yards. The shapes of the different continents and the positions of islands as at present on our maps and charts will never be altered except in insignificant degree, and the framework is ready for many years' work of land mapping.

It is not to be inferred from what I say that marine surveys are approaching their close. It is far otherwise. The time given to these enormous extents of coasts and seas, and the necessarily small scales on which the surveys have been carried on, have caused them to be very imperfect in all details. Hundreds of rocks and shoals, both stretching from the land and isolated in the sea, have been missed in the course of them, and loss of ships and life on these unknown dangers still continues. With the increase of shipping, increased number of ships of heavy draught, the closeness of navigation due to steam, and the desire to make quick passages, smaller inaccuracies of the charts become yearly of greater importance.

As an illustration of the condition of affairs, I may mention that in Hamoaze, the inner harbour of Plymouth, one of the headquarters of the British fleet for more than 300 years, a small but dangerous pinnacle of rock was only discovered five years ago; whilst numerous other dangers of a similar character have been yearly revealed in close surveys of other harbours in the United Kingdom, supposed to be well examined and charted in the last century.

There never was a greater need for close marine surveys of places frequented by ships than now.

It is interesting to look back and see the gradual progress of the delineation of the world and to mark how very recent any approach to accuracy is.

The very earliest maps of any extent of country are unfortunately lost to us. The first man who made a map of which any historical record exists is Anaximander of Miletus, about 600 B.C., but we know nothing of it. A map is mentioned by Herodotus as having been taken in 500 B.C. by Aristagoras of Miletus in the shape of an engraved bronze plate whereon the whole circuit of the earth was engraved, with all its seas and rivers, to influence Cleomenes, King of Sparta, to aid the Ionians against Persia. This was probably the work of Hecatæus, to whom early Geography owed much. His works are also only known to us by quotation; but they are especially interesting as containing an early idea of the limits of Africa, which he represents as entirely surrounded by the sea—a circumstance apparently either forgotten or disbelieved in later years.

Erotosthenes, 250 B.C., and Hipparchus, 150 B.C., made great ad-

vances, and the former made the first attempt to measure the size of the earth by the difference of latitudes between Assuan and Alexandria in Egypt—an attempt which, considering the great imperfection of his means, was remarkably successful, as, assuming that we are right in the length of the stadium he used, he made the circumference of the globe 25,000 geographical miles, whereas it should be 21,600.

He also devised the system of meridians and parallels as we now have them; but the terms "latitude" and "longitude," to denote positions on those circles, were introduced by Ptolemy.

The maps of Ptolemy, the great Alexandrian astronomer and geographer of A.D. 150, are the earliest we possess. He drew, besides a general map of the whole known world from the southern part of the Baltic to the Gulf of Guinea, north and south, and from the Canary Islands to the China Sea, east and west, a series of twenty-six maps of the different parts.

Ptolemy's maps and his method of representing the spherical globe on a flat surface had a great influence on Geography for many years. After his time the Greek civilisation waned, and the general decline of the Roman Empire, followed by its disruption by the invasion of barbarians, closed the course of discovery in all branches of research for centuries. It is not too much to say that for 1300 years no advance was made, and until the commencement of exploration by sea, which accompanied the general revival of learning in the fifteenth century, Ptolemy's maps represented the knowledge of the world.

As might be expected, the further he got from the Mediterranean, the greater were his errors; and his representations of Eastern Asia and North-Western Europe are somewhat grotesque, though quite recognisable in the main.

Of Africa south of the Equator he knows nothing, and his map of it terminates with the border.

This is somewhat remarkable, as I am one of those who firmly believe in the circumnavigation of Africa by the Phœnicians sent by Necho, King of Egypt, in 600 B.C. from the head of the Red Sea. As described by Herodotus, the voyage has all the impress of veracity. My personal faith in Herodotus was much strengthened by finding, when I surveyed the Dardanelles in 1872, that his dimensions of that strait were nearer the truth than those of other and later authorities, even down to the time at which I was at work, as well as by other geographical tests I was able to apply. When, therefore, he records that the Phœnicians declared that in their voyage they had the sun on their right hand, and says he does not believe it, he registers an item of information which goes far to prove the story correct. Influenced by Hecatæus, who, though surrounding Africa by the sea, cut it far short of the Equator, Herodotus could not conceive that the travellers had passed to the south of the sun when it was in the southern tropic.

No historical incident has been more discussed than this voyage, commentators varying much in their opinions of its truth. But we have to-day some new facts. No one who has followed the exploration of the ancient buildings in Rhodesia, and considered the information we

possess on the early inhabitants of Southern Arabia, whether we call them Sabæans or Himyarites, can doubt that the former were mainly the work of men coming from Arabia at a very early date, while the period of time necessary to carry out gold-mining operations over the large areas now found to have been exploited must have been very great.

It seems strange that no record of the constant voyages to this El Dorado should remain, but the very natural desire to keep lucrative information to themselves is not an unknown thing amongst traders of the present day, while the conditions of society and the absence of written records of South Arabia would make concealment easy.

The Phœnicians, an allied race, and the great seafaring trading nation of the Mediterranean, succeeded in keeping the majority of their marts secret, and we have incidents recorded showing their determination not to allow others to follow their steps, while to this day we are very doubtful of the limits of their voyages.

It may be considered certain that while we naturally quote Greek historians and geographers as the early authorities for the growth of geographical knowledge, and while the scientific basis for proper maps of large areas was really provided by them, the seafaring nations, Arabians, Phœnicians, and Chinese, knew a very great deal practically of the coasts of various parts of the Old World that were absolutely unknown to the Greeks.

The favourable conditions afforded by those remarkable periodic winds, the monsoons, would in the China Sea, Bay of Bengal, and the Arabian Sea naturally facilitate any attempts at extensive sea voyages, and would lead to such attempts under conditions that in the regions of variable winds would be considered too dangerous and uncertain. The fact that the monsoons in nearly every case blow practically parallel to the coasts in opposite directions is a most important factor in considering early navigation. The direction of the wind itself in such cases roughly guides a vessel without a compass, and the periods of cyclones and unsettled weather between the monsoons would soon be noted and avoided, as they are to this day by the Arabs and Chinese, whose vessels, I have very little doubt, have remained practically the same for thousands of years.

The unknown Greek author of that unique and most interesting document, the "Periplus of the Erythræan Sea," probably of the first century A.D., describes vessels built without nails, the planks of which were bound together by cords, in precisely the same way as many Arab dhows now navigating the Indian Ocean. His personal knowledge of Africa evidently ceased at Cape Guardafui, though he gives information gained from others on the East Coast as far as Zanzibar, which—or, rather, a part on the mainland near—he describes as the limit of trade to the south. We know that Arabs had penetrated further, but no doubt they kept their knowledge to themselves.

These early navigators very probably had charts. When Vasco da Gama first passed along the eastern coast of Africa he found that the Arab dhows had charts. Unfortunately none of them has come

down to us, or it would have been interesting to compare them with those of the West Coast used by the Portuguese at the time, which were of the crudest description.

I claim for sailors of all ages that they would be the first to make practical maps of the shape of the coasts. Their safety and convenience demanded it, while it is a far easier task to compile such a picture of the earth from successive voyages along coasts over the sea, where average distances from known rates of sailing and courses from the sun and stars can be more accurately ascertained, than from long and generally tortuous land journeys in directions governed by natural features, towns, and so forth. A navigator *must* be a bit of an astronomer. A landsman to this day seldom knows one star from another.

It was the sea-charts, or *portolani*, of the Middle Ages that on the revival of learning first gave respectable representations of the shape of the coasts, at a time when the learned monks and others were drawing the most fantastic and absurd pictures which they called maps.

At the same time it must be remembered that in all ages and down to the present day pilots, who within a hundred years were usually carried by all ships, even for sea voyages, jealously keep their knowledge largely in their heads, and look upon good charts as contrivances to destroy their profession, and that such charts or notes as they had they would keep religiously to their fraternity.

The Egyptians were no sailors, but we know that they habitually employed Phœnicians for sea expeditions, while we have the historical record of the Old Testament for their employment by David and Solomon for a like purpose in the Red Sea, and probably far to the south. It is, therefore, almost impossible to doubt that the Phœnicians were also acquainted with the navigation of the Red Sea and east coast of Africa. Such a voyage as that recorded by Herodotus would in these circumstances be far from improbable.

The varying monsoons which had led the Arabians centuries before to get so intimate a knowledge of the east coast as to enable them to find and work the goldfields would be well known to the Phœnicians, and the hardy seamen who braved the tempestuous regions lying between Cadiz and Great Britain would make little of the difficulties of the African seas.

The limit of easy navigation from and to the Red Sea is Sofala. I do not think that it is too great a use of the imagination to suppose that it would be from information received in what is now Rhodesia that it was learned that to the westward lay the sea again, and that this led to the attempt to reach it by the south.

Once started from the neighbourhood of Sofala, they would find themselves in that great oceanic stream, the Agulhas Current, which would carry them rapidly to the southern extremity of Africa.

I, as a sailor, can also even conceive that, finding themselves in that strong current, they would be alarmed and attempt to turn back, and that after struggling in vain against it they would have accepted the inevitable and gone with it, and that without the Agulhas Current no such complete voyage of circumnavigation would have been made.

As Major Rennell in the last century pointed out, once past the Cape of Good Hope, the periodic winds, and over a great part of their journey the currents, would help them up the West African coast; and the general conditions of navigation are favourable the whole way to the Straits of Gibraltar, the ships keeping, as they would do, near the land; but we can well understand that, as recorded, the voyage occupied nearly three years, and that they halted from time to time to sow and reap crops. I should say that it is highly probable that either Simon's Bay or Table Bay was selected as one of these stopping-places.

No reference to this voyage has been found amongst the hieroglyphic records, and, indeed, so far few such records of Necho, whose reign was not for long, are known; but that it was regarded at the time as historical is evident, for Xerxes, a hundred years later, sent an expedition to repeat it in the contrary direction.

This, however, failed, and the unfortunate leader, Sataspes, was impaled on his unsuccessful return.

This attempt shows that the greater difficulty of the circumnavigation from west to east, as compared with that from east to west, was not realised, and points to the concealment of any details of the successful voyage.

Of Hanno's voyage from the Straits of Gibraltar to about Sierra Leone, the date of which is uncertain, but from 500 to 600 B.C., we should know little had not good fortune preserved the record deposited in a Carthaginian temple.

But the well-known secrecy of the Phœnicians in all matters connected with their foreign trade and voyages would explain why so little was known of Necho's voyage, and our present knowledge of the extensive ancient gold workings of Rhodesia shows how much went on in those times of which we are wholly ignorant.

I have dwelt perhaps too long on this subject, but it has to me a great interest; and as it has not, so far as I know, been dealt with by a seaman who is personally well acquainted with the ways of seamen in sailing ships and with the navigation of the coasts in question, I hope I may be excused for putting my views on record.

There are several references in Greek and Latin historians to other circumnavigations, but none of them can be trusted, and apart from Necho's voyage we hear nothing of the east and south coasts of Africa until the arrival of the Portuguese at the end of the fifteenth century. But they found a thriving civilisation along the coast from Sofala northward, Shirazi, Arab, and Indian.

Ruins exist in many places which have not yet been properly investigated, and we are quite unable to say from what date we are to place the earliest foreign settlements, nor how many breaks existed in the continuity of the gold-mining, which apparently was proceeding at or very shortly before the Portuguese visit.

After the recommencement of exploration by sea in the fifteenth century, seamen slowly gathered enough information to draw the lines of the coasts they passed along, and in time—that is, by the middle of the eighteenth century—most lands were shown with approxi-

mately their right shapes. But of true accuracy there was none, for the reason I have before mentioned, that there was no exact method of obtaining longitude.

If we look at a general world chart of A.D. 1755—and to get the best of that period we must consult a French chart—we shall find on this small scale that the shape of the continents is fairly representative of the truth. But when we examine details we soon see how crude it all is.

I have compared with their true positions the positions of thirty-one of what may be taken as the fundamental points in the world as given in the larger-scaled French charts of 1755, from which the general one is drawn, and I find that on an average they are forty-eight miles in error. The errors vary from 160 miles to two miles. If the dilineation of the coastlines between be considered, the inaccuracies are very much greater.

Very shortly after this date more accurate determinations began to be made. The method of lunar distances was perfected and facilitated by tables published in the various astronomical "ephemerides," and seamen and explorers commenced to make use of it. Still the observation required constant practice, and the calculation, unless constantly made, was laborious, and it was used with complete success by the few. The great Captain Cook, who may be looked upon as the father of modern methods of surveying, did much to show the value of this method: but the chronometer came into use shortly after, and the principal advance in exact mapping was made by its aid, as I have already stated.

There is a vast amount yet to be done for Geography. Until we possess publications to which we can turn for full information on all geographical aspects of things on this globe of ours, there is work to be done. Seeing that our present publications are only now beginning to be worthy of being considered trustworthy for the very small amount of knowledge that we already possess, geographical work in all its branches is practically never-ending.

But of exploration pure and simple very little remains to be done. The charm of travelling through and describing an entirely new country which may be practically serviceable to civilised man has been taken from us by our predecessors, though limited regions still remain in Central Asia and South America of which we know little in detail.

I must except the Polar regions, which are in a somewhat special category, as their opening up affords few attractions to many people. But a knowledge of the past history of our globe—fit study for human thought—can only be gained by study of the portions still under glacial conditions.

What is there round the South Pole—a continent or a group of large islands? What is going on there? What thickness does ice attain? Have these regions always been glaciated; and if not, why not? Can we get any nearer the mystery of magnetism and its constant changes by study at or near the magnetic poles? All these and many

other scientific questions can only be solved by general geographical research in these regions, and all interested in such questions have been delighted at the recent attempts to gain more knowledge.

The object of these expeditions was frankly and purely scientific. All hope of remunerative whale or seal fisheries had been dispelled by the visit of the Norwegian whalers in 1892 to the region south of Cape Horn, and the known general condition of the land forbade any expectation of other profitable industries, unless indeed gold and other valuable minerals should be found, which is always possible. Beyond the fact that exploring expeditions of this character keep alive the spirit of enterprise and bring out the finest characteristics of a race—which is a point by no means to be despised—no immediate practical benefit was to be expected.

Progress under the conditions must be slow, but I think that Great Britain may well be satisfied with the information collected in the Antarctic by Captain R. F. Scott and his gallant companions. The unfortunate detention of the *Discovery* by an unfavourable summer prevented the further coastal exploration which was part of the programme, but gave opportunity for further detailed examination of the inland conditions, which was carried out in defiance of the severest atmospheric and topographical difficulties, and with the greatest zeal and intelligence; and it may be doubted whether Science in the end has not gained more than she lost by the unexpected diversion of energy. The healthy conditions which prevailed throughout are a standing proof both of Captain Scott's eminent capacity as a leader and of the cheery spirit which animated the whole expedition.

The full results of the scientific observations are not yet worked out, and in many cases for a complete appreciation of their bearing they must be compared and correlated with those of the other Antarctic expeditions, but many highly suggestive points have already been revealed.

For the first time Antarctic continental land has been travelled over for long distances, and though the actual area of new discovery looks small on a map of the world, the distances covered can only be described as extraordinary, and far exceeding the most sanguine anticipations.

Few who considered the mountainous coastline of Victoria Land and its complete glaciation, as reported by Sir James Ross from his distant view, thought that it would prove practicable not only to ascend those mountains, but to reach to heights much surpassing them behind.

The reason that it proved feasible is that, while there are occasional heavy snowstorms, the annual snowfall is small, and the surface, therefore, is generally unencumbered with soft deep snow.

And what did Captain Scott find after his memorable struggle up the glacier through the mountains?

An enormous plateau at an elevation of about 9000 feet, nearly level, smooth, and featureless, over which he travelled directly inland for more than 200 miles, seeing no sign at his furthest point of any

termination or alteration in character. So far as could be seen from other journeys, glacial discharge from this great ice-sheet is very small, and practically it appears to be dead. Its accretion by fresh snowfall is insignificant, while on all sides along the flanks of the coastal mountains there are signs of diminution in the mass of ice.

The great ice-barrier east of Ross Island tells the same tale. This magnificent feature presents to the sea a face of perpendicular ice-cliffs varying from 60 to 240 feet in height and 450 sea-miles long. Sir J. Ross mapped its position in 1841, and Captain Scott finds that it has retreated on an average fifteen miles, varying much in different parts.

Should this rate of retreat continue the whole of this ice mass, so far as Captain Scott saw it, will have vanished in 1000 years.

As the motion of the ice mass is also about fifteen miles to the north in the same time, icebergs covering collectively an area of 450 miles by 30 have been discharged from it in sixty years.

Captain Scott travelled over it nearly due south to a point 300 miles from its face, and then saw no sign of its end.

It is bordered on its western side by a mountainous coastline, rising in places to 15,000 feet. He found the ice practically flat and wholly unfissured, except at the side, where its northerly motion, found to be about 130 feet in the month, caused shearing and vast crevasses. All that is known of its eastern edge is that it is bordered, where it meets the sea, by land from 2000 to 3000 feet high, suspected by Ross and verified by Captain Scott. This may be an island, or more probably the eastern side of the great fiord or bay now filled by the barrier.

Captain Scott is of opinion that this great ice-sheet is afloat throughout, and I entirely agree with this conclusion. It is unexpected, but everything points to it.

From soundings obtained along the face it undoubtedly has about 600 feet of water under it.

It is difficult to believe that this enormous weight of ice, 450 miles by at least 360, and perhaps very much more, with no fall to help it along by gravity, can have behind it a sufficient force in true land glacier to overcome the stupendous friction and put it in motion if it be resting on the bottom. It is sufficiently astonishing that there is force enough even to overcome the cohesion at the side, which must be very great.

The flat nature of the bottom of the Ross Sea and the analogies of many geographical details in other parts of the world make it most probable that the water under the whole barrier is deep.

A point on which I have seen no comment is the difference in the appearance of the slopes of Mount Terror. Captain Scott found the bare land showing over large areas, but during the two summers of Ross's visit it was wholly snow-clad. Sir Joseph Hooker, the sole survivor of Ross's expedition, when questioned had no doubt on the subject, and produced many sketches in support.

This may be due to temporary causes, but all the information collected by the expedition points without doubt to steadily diminishing glacia-

tion in recent times. We have, therefore, this interesting fact, that both in Arctic and Antarctic regions, as indeed all over the world, ice conditions are simultaneously ameliorating, and theories of alternate northern and southern maximum glaciations seem so far disproved.

But this does not mean that climatic conditions in the Antarctic are now less severe—probably the contrary. It has been pointed out by many that land glaciation may arise from varied primary causes, but one obvious necessity is that the snowfall should exceed melting and evaporation. It need not be heavy; but if it is, it may produce glaciation under somewhat unexpected conditions. This would entail a vapour-laden air more or less continuously impinging upon the land at a temperature which will enable it when cooled, either by passing over chilled land or when raised to higher regions by the interposition of mountains, to give up its moisture freely. This condition is not fulfilled when the air as it arrives from the sea is already at a very low temperature.

It was my fortune to spend two long seasons in the Straits of Magellan, and I was daily more impressed by what I saw.

There you have a mountainous range of no great height—very few peaks rising more than 4000 feet—opposed to the almost continuous westerly winds pouring in from the Pacific at a very moderate temperature and charged with much moisture.

The result is that in the latitude of Yorkshire every mountain mass over 3000 feet high is covered with eternal snow, and sends glaciers down to the sea.

I was convinced by what was going on under my eyes that it only required an upheaval of the land of 2000 feet or so to cover the whole of Patagonia with ice. But then the climate would still not be very severe. The temperature of the wind from the sea would be the same, and such part of it as blew along the channels and on the lower land would moderate the cold caused by the ice-covered slopes.

The shores of the whole of Western Southern Patagonia, deeply indented with long and deep fiords, indicate, according to all received views of the origin of such formations, that the land was formerly higher, while signs of glaciation are everywhere present.

The results of geographical research show us that in many parts of the world climate must have greatly changed in comparatively recent times.

In the now arid regions of Northern Africa, Central North America, and in parts of Asia there is ample evidence that the climate was in times past more humid. In a remarkable paper on the causes of changes of climate, contributed by Mr. F. W. Harmer to the Geological Society in 1901, and which has not obtained the notice it deserves, it is pointed out how changes in the distribution of the prevalent winds would vastly alter climatic conditions. Like everything else in Nature, and especially in the department of meteorology, these questions are exceedingly complex, and similar results may be brought about in different ways, but there can be no doubt that the climate of South

Africa would be greatly modified, and more rainfall would occur, if only the cyclonic storms which now chase each other to the eastward in the ocean south of the Cape of Good Hope could be prevailed upon to pursue a slightly more northerly line, and many obstacles to the agricultural prospects of South Africa now existing would be removed. This is, however, beyond the powers of man to effect; but, as I have just said, there are other ways of attaining the object, and it is earnestly to be hoped that the attention now being paid to afforestation may result in vigorous efforts to bring about by this means the improvement in humidity so much required in many parts of the country.

The other recent event in geographical exploration is the result of the expedition to Lhasa. It was an unexpected solution of this long-desired knowledge that it should come from political necessities and by means of a Government mission. The many ardent travellers who have dreamed of one day making their way in by stealth have thus been disappointed, but our knowledge is now fuller than could otherwise have been gathered.

The most important fact is the revelation of the fertility of a large part of Southern Tibet. Much has been added to topographical knowledge, but the route maps of the secret Indian native surveyors had already given us a rough knowledge of the country on the road to Lhasa. It was not, however, realised how great was the difference between the aridity of the vast regions of the north, known to us from the travels of men of various nationalities, and the better-watered area in the south, though from the great height of the plateau—some 12,000 feet—the climate is very severe. The upper course of the Brahmaputra has been traced by Captain Ryder, but, unfortunately, a political veto was placed on the project to solve the interesting problem of how this great river finds its way to the Indian plains, and this still remains for the future to unravel.

Of the ocean, which has been my own particular study for many years, and on which alone I feel any special qualification to speak, I have said but little, for the reason that when presiding over this Section on a former occasion I took it for my theme, but there are a few points regarding it which I should like to bring to your notice.

It is of the ocean, more than of any other physical feature of our globe, that our knowledge has increased of late years. Forty years ago we were profoundly ignorant even of its depth, with the exception of a few lines of soundings, then recently taken for the first submarine telegraph cables, and consequently we knew nothing of its real vast bulk. As to the life in it, and the laws which govern the distribution of such life, we were similarly ignorant as of many other details.

The *Challenger* expedition changed all this, and gave an impetus to oceanographic research which has in the hands of all nations borne much fruit.

Soundings have been obtained over all parts of the seas, even in the two polar seas; and though much remains to be done, we can now

form a very close approximation to the amount of water on our earth, whilst the term "unfathomable ocean" has been shown to have been based on an entire misconception. Biological research has also revealed a whole world of living forms at all depths of the existence of which nothing was known before.

In my former Address, eleven years ago, I gave many details about the sea, of which I will only repeat one—which is a fact that every one should know—and that is, that the bulk of the ocean is about fourteen times as great as that of the dry land above water, and that if the whole of that land were thrown into the Atlantic Ocean it would only fill one-third of it.

Eleven years ago the greatest depth known was 4700 fathoms, or 28,000 feet. We have since found several places in the Pacific where the depth is nearly 5170 fathoms, or 31,000 feet, or somewhat higher than Mount Everest, which has been lately definitely shown to be the culminating point of the Himalayas. These very deep parts of the ocean are invariably near land, and are apparently in the shape of troughs, and are probably due to the original crumpling of the earth's surface under slow contraction.

The enormous area of the sea has a great effect upon climate, but not so much in the direct way formerly believed. While a mass of warm or cold water off a coast must to some extent modify temperature, a greater direct cause is the winds, which, however, are in many parts the effect of the distribution of warm and cold water in the ocean perhaps thousands of miles away. Take the United Kingdom, notoriously warm and damp for its position in latitude. This is due mainly to the prevalence of westerly winds. These winds, again, are part of cyclonic systems principally engendered off the coasts of Eastern North America and Newfoundland, where hot and cold sea-currents, impinging on one another, give rise to great variations of temperature and movements of the atmosphere which start cyclonic systems travelling eastwards.

The centre of the majority of these systems passes north of Great Britain. Hence the warm and damp parts of them strike the country with westerly winds, which have also pushed the warm water left by the dying-out current of the Gulf Stream off Newfoundland across the Atlantic, and raise the temperature of the sea off Britain.

When the cyclonic systems pass south of England, as they occasionally do, cold north-east and north winds are the result, chilling the country despite the warm water surrounding the islands.

It only requires a rearrangement of the direction of the main Atlantic currents wholly to change the climate of Western Europe. Such an arrangement would be effected by the submergence of the Isthmus of Panama and adjacent country, allowing the Equatorial Current to pass into the Pacific. The gale factory of the Western Atlantic would then be greatly reduced.

The area south of the Cape of Good Hope is another birthplace of great cyclonic systems, the warm Agulhas Current meeting colder water moving up from the Polar regions; but in the Southern Ocean the conditions of the distribution of land are different, and these systems

sweep round and round the world, only catching and affecting the south part of Tasmania, New Zealand, and Patagonia.

In 1894 I spoke of the movements of the lower strata of water in the sea as a subject on which we were only beginning to get a little light. Since that year we have learned a little more. It is a common idea that at the bottom of the sea all is still; but this is a mistake, even for the deepest parts, for the tidal influence reaches to the bottom and keeps every particle in motion, though such motion is quiet and slow.

Near the shore, however, though still in deep water, the movement may be considerably increased. Cases have occurred in late years where submarine cables have broken several hundred fathoms deep, and when picked up for repair it has been found that the iron wire covering has been literally rubbed away as by a file. This can only be the result of an undercurrent along the bottom moving the cable to and fro. Such a current might be caused by a submarine spring, for there is no doubt that much fresh water finds its way into the ocean in this fashion, but it is more probably generally an effect of acceleration of the tidal movement due to the rising slope of the continent.

In connection with this, further facts have come to light in the course of recent marine surveys.

Many isolated shoal spots in the great oceans have figured in our charts, the results of reports by passing sailors who have said they have seen breakers in fine weather.

Such places are the terror of seamen, and it is part of the duty of surveying ships to verify or disprove them. Very much has been done in the last eighteen years, with the result that the majority of them have, as dangers, disappeared. In many cases, however, a bank has been found, deep in the ordinary acceptation of the word, but much less deep than the surrounding sea—solitary ridges, in fact, rising from the ocean floor. Frequently, in examining these banks in search of shoaler spots, breakers have been reported and recognised as such on board the surveying ship from a distance, but on approach they have proved to be small overcurls caused by tide ripplings, and the depth of water has proved to be several hundred fathoms. These ripplings are clearly caused by the small tidal motion in the deep water, generally in these cases of more than 2000 fathoms, meeting the slope of the submerged mountain range, being concentrated and accelerated until the water finally flows up the top of the slope as a definite current, and, taking the line of least resistance, that to the surface, makes itself visible in the shape which we are accustomed to associate with comparatively shallow water.

These cases form remarkable instances of the manner in which extensive motion of water may arise from very small beginnings.

An observation I was anxious to make in 1894 has been successfully carried out since. This was to ascertain whether there was any permanent undercurrent in the Straits of Bab-el-Mandeb due to more water being forced through the strait on the surface by the persistent south-east wind of winter than could be evaporated in the closed Red Sea.

Such return undercurrents have in somewhat similar circumstances

been shown to exist in the Dardanelles, Strait of Gibraltar, and in the Suez Canal.

The observation at Bab-el-Mandeb was difficult. The wind is strong and the disturbance of the sea is considerable, while the water is 120 fathoms or 700 feet deep. But a surveying vessel maintained herself at anchor there during four days, and, by the aid of an ingenious apparatus sent from England for the purpose, clearly proved the existence of a current of $1\frac{1}{2}$ knot flowing steadily at depths below 70 fathoms out of the Red Sea, whilst in the upper strata there was a similar current flowing in. In such ways is interchange of water provided for by Nature in places where tidal action does not suffice.

In what I fear is a very discursive Address I have not mentioned the interior of Africa. In the first place, it is a subject of itself; and as we shall have, I hope, many papers on African subjects, I have thought it better to deal mainly with generalities.

Still I cannot refrain from a few words to express the astonishment I always feel when I hear people complain that Africa goes slow. When I look at what has been effected in my own lifetime, it appears to me that, on the contrary, it has been rushed. The maps I learned from as a boy showed the whole interior as a blank. There are now no parts that are not more or less known. The great lakes have all been revealed; the great rivers have all been traced; Europeans are now firmly fixed with decent governments in parts formerly a prey to tribal wars and the atrocities of the inland slave traffic. Railways are running over regions unknown forty years ago, and one of the most astonishing things to me is that I should be able to hope now to visit in comfort and luxury the great Victoria Falls which my old friend Sir John Kirk—whom I left the other day hale and hearty—was, with the exception of Livingstone, the first white man to see, after a long and laborious journey in his company in 1860.

I could not help being amused as well as interested at seeing a short time ago a proclamation by the Government of Northern Rhodesia, dated not far from Lake Bangweolo, calling on all concerned to observe neutrality during the present war between Russia and Japan. I think that if any one had prophesied to Livingstone, as he lay in 1873 lonely and dying by the shores of that newly discovered lake, that such an edict would be issued in thirty years, he would have expressed a doubt as to its fulfilment.

To Southern Africa Nature has denied two of the features that facilitate rapid progress—good harbours and sufficient rainfall—but the energy of man has done wonders to provide the former where possible, and will doubtless do more; whilst I believe that the lack of the latter will also be overcome in the same way. The co-ordinated—or, in other words, the scientific—observations made in many other countries have pointed out a possible solution. On the other hand, the height of the inland plateaux makes it possible for the white man to live and work in latitudes which would under other conditions be tropical.

South Africa must have a great future before it; and while some present circumstances may delay development of its natural advantages,

I am inclined to think that in the long-run prosperity may be more solid and material for being reached in the face of difficulties, as has so often occurred in the history of the world.

THE EVOLUTION OF THE MAP OF SCOTLAND.

SECOND STAGE.[1]

By JOHN E. SHEARER, F.S.A.Scot., F.R.S.G.S.

(With Two Maps.)

SCOTIAE REGNUM, BY G. MERCATOR.

Published Düsseldorf (Duisburg in Nordenskiold), Germany, 1595.

THIS map of Scotland is by the Flemish mathematician, geographer, and map-maker, Gerard Kramer, usually called Mercator, who lived from 1512 to 1594, and was born in the small Flemish town of Rupelmonde. He studied at the University of Louvain. After 1536, when he married, he occupied himself with map-drawing and engraving. Mercator was imprisoned for a little time for heresy in 1544. In 1552 he moved from Louvain to Duisburg, and engraved a map of England for an Englishman whose name is not given, but who was probably Lhuyd or Christopher Saxton, his successor. Mercator worked at an atlas before Ortelius, and postponed his book owing to the atlas of Ortelius being published. (See Facsimile Atlas of Fifteenth and Sixteenth Centuries, by Nordenskiöld.)

The first edition of Mercator's atlas was brought out after his death by his son; a second edition in 1602, and later editions were published in Holland by the successor of Mercator, Jodocus Hondius. Mercator's name will live for all time as the inventor of Mercator's Projections, the lines so familiar to all on modern maps.

His name is one of the most famous among map-makers, but he did little to improve the map of Scotland except follow in the footsteps of other map-makers. After this map, for nearly a hundred years, there was no great improvement in our map of Scotland till the time of Pont and Gordon, who surveyed the country for themselves.

To show how little progress was made in the improvement of maps from the time of Ortelius down to the middle of the seventeenth century, I give in one column the number of islands in Loch Lomond shown on maps, and in another the number of lochs which are given as supplying water for the Rivers Teith and Forth:—

ISLANDS.		LOCHS.	
13	Ortelius	2	1571-73.
13	Mercator	3	1595
13	Speed	3	1610.
24	Gordon	7	1653-54.
13	Jansen	3	1659.

[1] Cf. this *Magazine*, p. 289. The author, who will publish at Stirling in a few months a work on *The Maps and Map-makers of Scotland*, will be glad to correspond with any one interested in the matter.

Ortelius shows two lochs as supplying the Teith and the Forth with water. At the side of one we find "Cambel Cast." (castle), and at the other "Monoch Cast." (probably Monachyle at Loch Earn); and a little further south Ortelius gives a large building named "Cast. Kery" with no loch, and Mercator, or his engraver, has chanced to add the loch, as this was, no doubt, thought to have been left out by mistake. These three lochs and three castles were faithfully copied for many years by map-makers.

Kingdom of Scotland, by J. Speed, London, 1610.

John Speed was born in Cheshire, and worked as a tailor in London. He was a historian and an antiquary, and brought out a large number of maps. His most important work was his Atlas of Great Britain, which passed through several editions.

This map of Speed's is very like Mercator's, which was in turn like the map of Ortelius. The principal points of interest are the sketches of Royal persons at each side of the map. As Speed was a tailor, the costumes may be considered authentic.

The left side of the map has James VI. of Scotland, who was baptized and crowned in Stirling, and his son, Prince Henry, who was born in Stirling Castle.

On the right side are given the wife of King James—Anne, Princess of Denmark; and Charles, Duke of Albany, who was crowned as Charles I. (See map at end.)

On another of Speed's maps of Scotland, in place of the Royal personages, a sketch is given of a Scotch man and a Scotch woman and a Highland man and a Highland woman. (See fig. p. 534.)

The district round Stirling is named Strieuling, and the town Sterling; Clamskenar is given for Cambuskenneth. The following are a few spellings:—Downcastle, Dunblain, Ynche Mohomo, Banoxborn, Alway Castle, Inder Ketthing, Cumirnald Castle.

Britain during the Anglo-Saxon Heptarchy.

By J. Speed, London, 1610 and 1627.

The Scotland of this map has been taken from the map of Ortelius, and not from Mercator, as was Speed's map of Scotland.

Scotia Regnum, by Robert Gordon of Straloch.

Printed Amsterdam, 1653-54.

Gordon was born in Aberdeenshire in 1580, and died 1661. He studied at Aberdeen and Paris, and was famous as a geographer and antiquary.

One author mentions that he prepared an Atlas of Scotland at the request of Charles I., which was published at Amsterdam in 1648, the year before Charles was executed; and it is also recorded that Gordon brought out at the same city a second Atlas of Scotland, called

"Theatrum Scotiæ," two years later, dedicated to Oliver Cromwell. Very probably it was the same book with a changed title to suit the changed circumstances. Gordon revised Pont's maps of Scotland for

From Speed's Map of Scotland, 1610.

Blaeu's Atlas, and in this atlas he has reprinted his map "Scotia Regnum," and his other map named "Ancient Scotland as known to the Romans," from his first publication. In the last-named map the Forth

is named Bodotria. Very near Stirling is found the Roman Station Lindum, and the Roman Wall (Antonine's) is named "Valli Adriani."

Scotia Regnum, by J. Jansen, 1659.

Printed Amsterdam.

Jansen's map appears to belong to an earlier period, and proves what has been stated, that Jansen worked up the material inherited from the Hondius family, who had succeeded Mercator.

Scotland, by P. Coronelli, Paris, 1708.

Dedicated to James III. (the Pretender to the Crowns of England, Scotland, and Ireland).

This map is adorned with signs or marks at different places, and there is a key at the side to give the meaning of these signs. Edinburgh, Glasgow, St. Andrews, and Aberdeen are marked as having universities, and over Stirling the word "Vic," which shows by the key that the author, who belonged to Italy, thought there was a Viscount of Stirling.

Interesting and little-known maps of Scotland published in France are those by Vander, 1660; Sanson, 1693; N. de Fer, 1680; G. A. Vindel, 1700.

Map of the North Part of Great Britain, by Herman Moll, Geographer to Her Majesty Queen Anne.

Published London, 1714.

This is a most interesting map, and a great amount of time could be spent upon it. It bears this inscription:—"Printed for H. Moll over against Devereux court in the Strand, J. Bowles, Print and Map-seller at the Black Horse in Cornhill, Tho. Bowles, Print and Map-seller next ye chapter house in St. Paul's Churchyard, and for John King, Print and Map-seller at the Globe in Poultry."

No roads were shown in the first edition, but when the King's roads were made by General Wade, after 1725, an edition was published with these roads, but having the old date, 1714. The Advocates' Library copy is one of these.

From about this time roads began to be shown in maps, which now grew larger, and many improvements were introduced.

At the sides of this map are eleven small engravings from Slezer's 1693 *Views of Scotland.*

Full details of the fish caught in the sea are given, and mention is also made of birds, fowl, etc.

The story of marvels is transferred to Loch Lomond this time, and we are informed that it has a floating island, fish without fins, and is frequently tempestuous in a calm. This is very like the statements made in 1314 about Loch Tay, and is little different from those made by Ortelius in 1570, who says Loch Lomond has great storms and fish

without fins.[1] At Iona we find printed, "Here is St. Ouran's Church, famous for the burying of 8 kings of Norway, 48 of Scotland, 4 of Ireland, and many other persons of distinction."

Moll brought out a large number of maps; a description of England and Wales, and the first complete County Atlas of Scotland (a volume of 36 maps), in 1725. ("Sold by H. Moll, Tho. and John Bowles, London.")

Moll followed the example of other geographers by bringing out an Atlas of the World. The work is named on the title-page "Atlas Minor or a new and curious set of sixty-two maps, in which are shewn all the Empires, Kingdoms, Counties, States, in all the known parts of the Earth." The maps occupy one sheet or two folded pages, and the boards of the atlas measure $9\frac{3}{4} \times 7\frac{3}{4}$ in. The atlas was printed for John and Carington Bowles, London, probably after 1725.

The Coast-Lines of Scotland, 1654 to 1721.

By J. Cowley, London, 1734.

This map shows the changes that have taken place in the coast-line, as shown on maps from 1654 to 1721.

Scotland, by C. Bowles.

Published London, 1735.

This is a large and very good map (4 feet by 3 feet 4 inches), with roads, Roman camps, forts, and military ways; counties coloured, county houses, a sign for churches, cross-swords at battlefields. Abbey Craig is named Abbot's Craig, and Airthrey is called Ethra.

This wording is printed on the map :—

"A new and complete map of Scotland, and islands thereto belonging. From actual surveys.

"The shires properly divided and subdivided, the forts lately erected, and roads of communication or military ways, carried on by His Majesty's command; the times when, and places where, the most remarkable battles have been fought. Likewise the Roman camps, forts, walls, and military ways.

"The Danish camps and forts. Also seats of the nobility in each shire distinguished, with several other remarkable places, that occur in the History of Scotland. Printed for Robert Sayer and Carington Bowles, London."

This map, which was published forty-two years before Nimmo's *History of Stirlingshire*, and before Kildean became so famous in history, has the Battle of Stirling Bridge marked as having taken place near the Old Bridge of Stirling.

---

[1] The *History of Scotland* by Hector Boece, published in 1527, was used by the early map-makers, and gave them these marvels, which they altered a little when drawing on their maps. In the hand-drawn map of 1564 by Mercator, the information taken from Boece is acknowledged.

Scotland, by John Ainslie, 1789.

"Drawn and engraved from a series of angles and astronomical observations, by John Ainslie, land surveyor, printed and sold by John and James Ainslie, Edinburgh, and William Faden, geographer to the King, London."

The map is $\frac{1}{4}$ of a mile to an inch, the hills are shaded, roads drawn, counties coloured, and a table of distances and heights of hills is given.

This map, which is a great improvement on previous maps, was printed on nine sheets, and when mounted on cloth with rollers measures six feet in length.

Burgh towns, which send members to Parliament, are marked with a star; market towns are in a special type; parish towns, manors, seats and noted houses, have special signs; Roman names, Roman roads, camps, country roads, military roads, turnpike roads, are printed in a special style, so that they are easily identified. This map gives much information about the Roman antiquities in Scotland.

There are only two battlefields marked in this map, and the most prominent is Culloden, 1746 (one that is as well not remembered), and the other is Largs, 1263.

Near Loch Etive this information is given, "Ruins of the city and castle of Beregonium, formerly the chief city of Scotland."

Scotland, by Lieutenant Campbell, 1794.

This map is named "A new and correct map of North Britain, with all the ports and military roads, divisions, etc. Drawn from most improved survey, illustrated with many additional improvements, and regulated by the latest astronomical observations."

There is a resemblance between this map and the map by Bowles of 1735.

On examining the map, there are many reasons for supposing that it is the work of a lieutenant in the Navy. Sandbanks and dangerous rocks are noted, and in many cases by whom discovered. Roads are also a special feature of this map.

A number of battlefields are marked, but either the drawer of the map or the engraver did not work with care. The Battle of Tippermuir of 1644 is spelled Tibbermoor, and Dupplin Battle of 1332 is shown as Dublin, 2nd September 1644. Bannockburn is found as 1318 in place of 1314. Kirkinthillo for Kirkintilloch, and King Water printed in place of River Allan near the small tributary named Knaik River, are a few of the curious points in this map.

This information, which looks better, is to be found at Shetland:—"The principal employment of the inhabitants is fishing and gathering kelp, or sea wrack. The Dutch used to resort once a year to Brassa Sound for cod and herring fishing, great plenty of wild fowl and venison on the island."

Ailsa Craig, in the Frith of Clyde, has the following:—"Ilsay or Ailsa, a rock of 940 feet high, belongs to the Earl of Cassils, and is let

for £30 per annum for the liberty of taking the young of birds which resort to it, called Sollan geese."

Scotland, by G. D. Macpherson, 1796.

The title of this small and interesting map is "An Historical Map of Scotland, with the north part of England, adapted to the year 1400, and constructed from most authentic materials. London, 1796."

On the title a figure points a hand to Scotland, and at the side is printed—

> "There Roman eagles fled from conquering foes,
> The rugged rock, the barren desert smil'd;
> For I, and loose-rob'd Freedom, walk'd the wild."

Parliamentary Map of Scotland, 1799.

A small map printed in colours for the House of Commons, distinguishing Lowland, Highland, and intermediate districts, for a Report respecting distilleries.

Kirkwood's Travelling Map of Scotland, 1804.

This, the first of the folding pocket maps of Scotland, mounted on cloth, and in a leather case for travellers, is a very creditable publication. The map measures 28 by 23 inches. This map shows the military districts with their headquarters, navigable rivers, and how far navigable, population of the counties, heights of mountains, and gives an account of the canals; the proposed canal from the Solway Frith, by Carlisle (near the Roman Wall) to Newcastle, is sketched.

The roads taken by Pennant on his first tour are coloured red, Dr. Garnett's coloured yellow, Lettice's coloured blue, and Campbell's coloured orange. A list of the towns and villages visited is given in addition for each of these tours; a table of distance is also on this map. Published by J. Kirkwood and Sons, Edinburgh.

Arrowsmith's Map of Scotland, 1807.

This is a grand piece of work, and is minutely and carefully engraved. The hills are shaded, small streams and names of places in great abundance. The map will compare favourably with maps of the present day, and a novelty in map-making now appears—the fresh-water lochs are coloured.

This wording is found on the map:—"Constructed from original materials obtained under the authority of Parliamentary Commissioners, for making roads and building bridges in the Highlands of Scotland. By A. Arrowsmith, London, 1807." Size, 6 feet by 4 feet 9 inches.

Arrowsmith's 1815 Map of Scotland.

This map only measures 23 by 19½ inches. The different classes of roads are printed in colour, and are easily identified. It is thus described

on the title:—"From original materials obtained by the Parliamentary Commissioners for Highland roads and bridges, and exhibiting the roads, bridges, and harbours made, contracted for, or under consideration."

The following set of maps published in Edinburgh is well engraved, and the maps of the appendix are very interesting.

Lothian's County and Historical Maps of Scotland.

The Atlas was published in 1826, and the maps, folded up in four cases, in 1834-35. Scotland is shown on thirty-three coloured maps, size $9\frac{1}{2} \times 7\frac{1}{2}$. The frontispiece of the atlas shows the comparative heights of sixty-nine principal hills in Scotland, and at the end of this set of maps one is given named "General Map of Scotland."

Appendix—Scottish Historical Maps.

Ptolemy's Map of Scotland, A.D. 146.
Richard (of Cirencester), Map of Scotland.
Scotland under the Romans (A.D. 80 to 446), with ancient and modern names; and shewing the Sites of the Roman Camps, Native Forts, Druidical Circles, etc.
Scotland under the Picts (A.D. 446 to 843).
Scotland under the Picts and Scots (A.D. 843 to 1017).
Scotland in the Fifteenth Century, with the names as then written: and shewing the Divisions into Earldoms, Lordships, Districts, etc.
Highlands of Scotland (A.D. 1715 to 1745), with the Territories of the Clans and the Route of Prince Charles.
Modern Scotland.

THE NEGRITOS OF ZAMBALES.[1]

We have received a copiously illustrated pamphlet on this subject, which contains the fruits of a journey of investigation undertaken by Mr. W. A. Reed during May and June 1904, in the province of Zambales in the Philippine Islands, and as the subject is of much interest, we summarise here Mr. Reed's observations.

The special account of the Negritos of Zambales is prefaced by a chapter on the distribution of these interesting and little-known pigmies in the Philippines. As regards the number and distribution of breeds having a preponderance of Negrito blood, the author gives it as his opinion that the Negrito population of the islands does not exceed 25,000, and that the group which is largest in numbers, and probably purest in type, is that which occurs in the Zambales mountain range, in

[1] *The Negritos of Zambales*, by William Allan Reed. *Department of the Interior, Ethnological Survey Publications*, volume II. part i. Manila: Bureau of Public Printing, 1904.

western Luzon. Apart, however, from Zambales and the contiguous provinces, Negritos of more or less pure type occur in at least eleven other provinces of Luzon. Of the northern islands which contain Negritos those of Panay, Negros, and Mindanao may be mentioned as possessing breeds which are to a large extent pure. On the east side of Luzon and in the island of Paragua there is marked evidence of mixture.

The social state of the Negritos is everywhere the same. They support themselves chiefly by the fruits of the chase and the natural products of the forest, and at best only cultivate small patches of maize and other vegetables. Only occasionally do they live in settled, self-supporting communities, and they are for the most part nomadic in habit.

As regards the Negritos of Zambales, something must first be said as to the geographical features of the area in relation to the persistence here of a more or less pure stock. The province extends along the western coast of Luzon for more than 120 miles, but has an average width of only about twenty-five miles. Its eastern boundary is formed by a mountain chain whose highest peak, called Mt. Pinatubo, reaches an altitude of 6040 feet. The rivers of the province rise in the mountains, and have therefore a short and rapid course to the sea. Their number, and the fact that they are as yet unbridged, in combination with the stormy and harbourless coast, explain the slow development of the region, which is fertile, well-watered, and bears valuable forests. The people are indolent and backward. The Negritos of the province inhabit the mountainous portion of the lower half of Zambales and the contiguous provinces of Tarlac and Pampanga.

The area occupied is broken and rough, consisting for the most part of rolling tablelands interrupted by low ridges and dotted with mountain peaks. Though there is abundance of fertile land, practically none of it is occupied. The rancherias of the Negrito stock are usually built on the tableland above some stream, with the little clearing on the slope of the ridge at the base of which the stream runs.

The racial characteristics are the small stature, the "kinky" hair, and the almost black skin. The small stature seems, however, to have been unduly emphasised, for the Negritos are by no means dwarfs. The height varies from 4 to 5 feet. Among seventy-seven individuals measured, the tallest male was 5 feet 2 inches, and the tallest female 4 feet 11 inches. The shortest individuals were 4 feet 2 inches and 4 feet respectively. The clothing in the case of the males consists of the breechcloth, and occasionally of a shirt in addition, while the women wear a saya or skirt, extending to the knees. The colour which is usually worn is black.

According to the author, the general condition of the race is pitiable, for there is a continued struggle for food. Clothing and shelter rank in the Negrito's estimation as of much less importance than food. The commonest form of hut consists of two forked sticks driven into the ground so that they stand about 8 feet apart and 4 feet high. In the two forks a horizontal piece is laid, then some strips of bamboo are inclined against the crosspiece, the other ends resting on the ground.

Some cross-strips are tied with bejuco to these bamboos, and the whole is covered with banana leaves. If the materials are at hand, such a rain shelter can be constructed in half an hour. The more prosperous Negritos in the long-established rancherias build four-posted houses of bamboo with roof and sides of cogon grass. In such houses the floor is four feet above the ground, and the cooking is done beneath it. A small fire is kept burning all night, and the inhabitants of the house sleep just above it, and thus obtain some warmth. No blanket or covering of any sort is used.

The fire is never allowed to go out, partly on account of the necessity for warming the hut, and partly because the obtaining of a light is a matter of some difficulty. Primitively fire was obtained by the friction method, which is still familiar to all the members of the tribe, but this has now been practically replaced by the flint and steel. The steel is hard to get, and is greatly prized; it is obtained in trade. The flint and steel are habitually carried in a little grass basket, usually suspended from the neck.

Some of the Negritos possess earthenware vessels, and a few even an iron pot, but the normal cooking-vessel for rice and similar foods is a joint of green bamboo. Meat is roasted on a strip of cane, and maize on hot coals. The diet, if usually scanty, is very varied, there being few products of the forest, animal or vegetable, which are not utilised. What agriculture is practised is of very simple type, the plants grown being chiefly tobacco, maize, and vegetables. All planting is done in cleared spaces in the forest, the soil there being loose, and therefore requiring no ploughing. The clearings are always small, and are made by cutting away and burning the small trees and undergrowth, and ringing the large trees. All the work of digging, planting, and cultivating is done with sharpened sticks of hard wood, which are called "ti-ad." The only other tool the Negritos possess is the bolo, with which all operations requiring cutting are done. In the preliminary operation of clearing, men, women, and children take part; but as elsewhere at this grade of civilisation, the weeding and care of the crop falls largely upon the women and children, while the men hunt and fish. The clearing is the personal property of the head of the family which cleared it, and the tribe show a very remarkable respect for the rights of property.

The native manufactures are few in number. Bows and arrows are constructed with some skill, and the women weave coarse baskets of bamboo. What trade with the inhabitants of the lowlands exists depends upon such forest products as bejuco, beeswax, and mountain roots, and on the tobacco grown in the clearings. In exchange, the Filipinos supply the Negritos with small quantities of cloth, rice, iron, and steel.

Agriculture and trade being so little developed, the Negrito is naturally a hunter by instinct, and such skill as he possesses is in large part expended in the manufacture of traps. A somewhat complicated form of trap known as "belatic" is employed for deer, but has probably been adopted from the Malays. For birds a simple form of spring-trap is

used. Deer are also hunted with bows and arrows, the Negritos showing themselves tireless in the chase. When the hunt is ended the spoils are carefully divided, the division being performed according to a fixed etiquette by the most important man present, and being preceded by an offering to the spirits. The offering consists of a small part of the entrails and heart, which is cut into small pieces and scattered in all directions, the ceremony being accompanied by a form of words which means: "Spirits, we thank you for this successful hunt. Here is your share of the spoils."

In regard to amusements, the only game which was recognised was a gambling game played with dice ("saro"). The children do not appear to have definite games, the struggle for existence apparently beginning at too early an age for this to be possible. The adults, however, show great love of music, and considerable skill in dancing. The music is of the most primitive type, and the instruments are crude. The commonest is the bamboo violin, a simple instrument which is very easily constructed; rude guitars are also occasionally found. Mr. Reed was only able to trace two songs. One of these is an interminable love-song, and the second is sung on festive occasions when visitors come. In this case the words vary according to the occasion, but the tune and manner of rendering are invariable. As regards dances, apart from the general forms which afford an outlet for exuberant spirits, there are several mimetic dances with a special meaning. The women are not such energetic and tireless dancers as the men.

As regards the social life of the Negritos, various interesting facts are set forth by Mr. Reed. The marriage customs appear to be relatively simple. In the details of the ceremony there is considerable variation, but in all cases the essence of the matter is the bestowal by the prospective bridegroom of gifts upon the friends of the bride. The fathers regard their daughters in the light of assets, and will only part with them for a consideration. Betrothal at a tender age is not unknown, the motive being apparently the desire of the girl's parents to obtain early possession of her purchase-money; while on the other side the parents of the bridegroom pay less than if the girl were of marriageable age. But the Negrito maidens are apparently by no means purely passive, for Mr. Reed encountered a case where a girl who had been betrothed in childhood refused for two years, in spite of threats and entreaties, to carry out the contract made on her behalf. In some of the rancherias, when the payment has been made, dancing and a feast complete the ceremony. In other places an interchange of food takes place between groom and bride. In either case the contract is completed by a ceremonial home-coming, when the new-made wife is led in procession to her new home, and during her progress is presented with gifts by her husband.

There is no feeling against polygamy, but in the marriage-by-purchase system it is naturally only the well-to-do who can afford more than one wife. Divorce is stated to be infrequent, and when separation by mutual consent occurs the children go with the mother, and the property is divided equally. When a woman deserts her husband for

some one else, the new husband is required to recompense the injured party for his loss. If he cannot be got at, the relatives of the woman must pay back to the husband the sum which he originally paid for her. In general, the morals of the Negrito community seem to be high, though, as in so many similar cases, contact with more "civilised" peoples leads to a lowering of standard.

As regards superstitions, Mr. Reed's opportunities for observation have not been sufficiently great to allow him to say much. The tribe seems to believe in the universal existence of spirits or anitos. Disease is usually considered to be a punishment for wrongdoing, the more serious diseases coming from the supreme anito, and the lesser forms from the less important anitos. For these minor diseases there are exorcists or medicine men and women, but as the death penalty is sometimes exacted for failure to cure, the profession is not popular. In addition to the ministrations of the medicine men various charms are employed, and there is apparently the beginnings of a pharmacopœia. The practice of blistering is also common.

The Negritos which live in the wild state have a very simple form of government. Each head of a family is a small autocrat, and rules his family, including those of his sons who elect to stay with him. When a group of families lives in one locality, one man, chosen for superior ability or wealth, is recognised as capitán or headman, and settles disputes between families.

THE ZIEGLER NORTH POLAR EXPEDITION.

On August 10 the *Terra Nova*, one of the relief ships of the Ziegler North Polar Expedition, arrived at Tromsoe with the members of the expedition on board, and brought news of the loss of the *America*, the vessel of the expedition, on November 16, 1903.

According to the summary which has appeared, the *Terra Nova* left Tromsoe on June 14, and on the 16th shaped a course from Nordkyn towards the icefield, which was sighted on June 19 in latitude 75° 57′ N. and longitude 36° 26′ E. The condition of the ice was very unfavourable. The ship turned east, along the edge of the field, through a fog of unusual density. On the 24th she began to force her way slowly through the ice, and on July 25 struck open water. Next day she again encountered thick ice. Mr. W. S. Champ, the leader of the expedition, began to doubt the possibility of returning this year. At last, on the morning of July 28, Salmi Island was sighted through the mist. Next day the *Terra Nova* got the bearings of Aagaard Island, and reached Cape Dillon, where six men of the Ziegler Expedition were found safe and sound. These six men were sent on sleds to the Ziegler Expedition's camp, where Mr. Fiala was waiting with nine men, to inform them of the arrival of the *Terra Nova*. The steamer now headed for Cape Flora, where she arrived on the afternoon of July 30. Here twenty-one men were taken on board, whose condition was not so good. On the 31st the steamer returned to Cape Dillon, and Mr. Champ left on a sled over solid ice for

the Ziegler camp to help Mr. Fiala. On August 1 all had returned on board, and the *Terra Nova* sailed for home. After many difficulties she got out of the pack-ice on August 6, and returned to Tromsoe as indicated above.

The *Magdalene*, the second relief ship of the Ziegler Expedition, which left Tromsoe in the middle of June for Shannon Island, also returned early in August, and reported that on July 21 no member of the expedition was to be found on that island. It will be recollected that the *Magdalene* was despatched to Shannon Island on the chance that the original expedition in the *America*, or a party from that vessel, might have been caught in the ice and drifted westwards towards the coast of Greenland. Her report shows that this did not occur. The actual history of the expedition may be gathered from the following summary of Mr. Fiala's report.

The *America*, with the Ziegler Polar Expedition on board, left Vardo on July 10, 1903, and, sailing and steaming northward, reached the edge of the ice at 38° 57′ E. longitude, 79° 57′ N. latitude. She then steamed eastward along the edge of the ice until close to Novaya Zemlya, and, not being able to find an opening, Mr. Fiala determined to force his way through the icefields at the 48th meridian, where the conditions seemed most favourable. Here again the ice was in exceptionally large unbroken fields, and fog caused much delay. The vessel was imprisoned in the ice in sight of Cape Flora for four days, and the party were finally obliged to use heavy mines of gun-cotton to break a passage between the immense masses of ice and to allow the ship to escape into open water.

On August 12, 1903, the *America* arrived at Cape Flora, and only waited long enough to land a small supply of provisions. She then fought her way slowly up the British Channel, a fortunate drift in the close-packed ice assisting in the advance north. At the end of August she reached Teplitz Bay, Crown Prince Rudolf Island, the most northern harbour in Franz Joseph Land, which formed the base camp of the expedition during the whole of its stay in the Arctic, and was named Cape Abruzzi in honour of the Italian explorer.

The first work was to land the cargo, ponies, dogs, stores, and equipment, which was done under considerable difficulty, as nearly a mile of rough ice intervened between the ship and the shore. A house was then constructed as living quarters for the field party; magnetic and astronomical observatories were built, and tents were erected for ponies, dogs, and stores.

On October 22, in the darkness of the Arctic night, the ship first narrowly escaped destruction with over half the party aboard. During a heavy gale the *America*, which was less than a mile from the land headquarters, mysteriously disappeared. It was found that she had been blown adrift, with her mooring lines entangled in her propeller. Three days later she returned, having lost her large anchor and chain. Every one on board had been up day and night, none ever thinking that they would survive. The ship then froze in, and seemed safe enough to all, but on November 12 the ice pressure became so great that the ship was damaged, but to what extent it was impossible to tell.

Early in the morning of November 21 the party were awakened by the crashing and thunder of the ice in motion, great pressure ridges forming around the *America*, and tearing out her stern and penetrating her side, while tons of ice demolished her rail and crashed on deck. She was soon a wreck and in a sinking condition, the rising water having extinguished her fires. There was nothing for it but to abandon the vessel, and as this was done a final pressure raised her high on the ice. The house ashore was then enlarged with the wreckage from the ship so as to accommodate the entire party of thirty-nine men and supplies. Ship's boats and coal were sledged ashore from the *America*. The heavy winds and frequent storms, combined with the darkness and cold of the Arctic night, made this outdoor work difficult.

Preparations for the spring sledge journey kept every one busy during the winter, and scientific work was prosecuted under all conditions of weather and temperature.

On the night of January 22, 1904, during a gale of wind that registered at its maximum 72 miles an hour, all the old ice in Teplitz Bay, with several miles of the glacier face, were broken up and carried away, and with the bay ice disappeared all that was left of the *America*, together with 100 tons of coal and 40 tons of provisions which had been cached on the ice, and could not be sledged to camp on account of the almost continuous storms.

The first sledge party, which intended to leave for the north in February, had to be postponed on account of the storms and high temperature, which made an open sea for almost the entire winter off the north-western coast of Rudolf Island. The slushy ice rendered advance either by boat or sledges impossible. Two attempts made in March failed.

On March 7 the first sledge party left, and was stormbound for a number of days at Cape Fligely, being obliged to return owing to the injuries sustained by several of the men and also in order to repair equipments. The second party left Teplitz Bay on March 25, and crossed the glacial ice to Cape Fligely, whence it descended to the sea ice. The ice conditions were frightful, and nearly every one of the sledges was hopelessly smashed, making it absolutely necessary, if the equipment was to be saved for another attempt in the following year, that the party should return to Camp Abruzzi. Though this column only reached a comparatively short distance from land, all the way had to be cut with ice axes, and it now became clear that it was useless to attempt to get further north during the spring of 1904.

Leaving a small company of volunteers at Camp Abruzzi to stay through another winter for the purpose of a further attempt north in 1905, Mr. Fiala conducted a party composed of twenty-five men, sixteen pony sledges, and eight dog teams and sledges to Cape Flora, there to await the relief ship. After the arrival of the relief ship it was his intention to return to Camp Abruzzi with two of the men.

The journey to Cape Flora occupied sixteen days, the party arriving there on May 16, 1904. The worst experience on this trip, and one that, combined with the loss of the ship, saddened the whole party, was an outbreak of glanders among the ponies, the spread of which rendered

necessary the destruction of all these animals except two on arrival at Cape Flora.

From May 16 to September 10 a ceaseless watch was kept for the relief ship, by which date the party had to face the fact that relief was hopeless, and that all would be compelled to spend a second winter in the Arctic. In the meantime preparations for the winter and the collection of supplies were in full progress to augment the stores of food left at Cape Flora by previous expeditions. At this time an important discovery of coal was made at a point 600 ft. up the side of a steep mountain. Coal was dug out of the frozen ground and a winter supply laboriously conveyed down the mountain on men's backs to camp.

All hope of relief having been given up, and all arrangements having been made for the provision of the party at Cape Flora, Mr. Fiala prepared to return to Cape Abruzzi for the further attempt to reach the Pole in 1905. Accompanied by Mr. W. J. Peters, the second in command, and a small sledge party, he reached Cape Abruzzi by moonlight on November 20, 1904, the party having been marching from Cape Flora since September 19. This was a dangerous and eventful trip, for a large portion of the way had to be traversed in the darkness. A stop was made on the way at Camp Ziegler, Alger Island, where two of the party were left, one whose toes had been frost-bitten and the other to keep him company. This journey was performed in very unfavourable conditions; particularly the latter part, where the rough channel ice had to be crossed in dense darkness. Time and time again men and dogs would fall into holes and crevices in the ice or run up against great walls of ice, the leading men going ahead without being able to see any possible foothold. While crossing Hooken Island glacier, two of the party fell into a crevasse and at a distance of 65 feet were wedged in between the walls of ice. Their rescue was attended with great difficulty, one being so much injured that he had to be dragged part of the distance north lashed to a sledge.

On arrival at Camp Abruzzi on November 20, the party heard of the death of Sigurd Myhre, a Norwegian fireman, of the lost ship *America*, who had succumbed from natural causes during their absence. His remains had been interred on the summit of a ridge north of Teplitz Bay, in a great mound of rocks surmounted by a large cross. With this exception all the party were in good health, and had been hard at work during the absence of the others at Cape Flora preparing for the winter of 1904-5. Between November and February every man was busy preparing for the spring sledge trip—equipment had to be overhauled and repaired, sledges strengthened, and a small canoe built. The party was ready to leave in February, but the weather in the spring of 1905 was even worse than during the previous year.

Bad weather and high temperature delayed the northern trip until March 16, and at 10.15 A.M. on that date the sledge party left Camp Abruzzi for the ice-pack north, crossing the glacier to the east towards Cape Rath. Though newly-formed smooth ice seemed to stretch to the horizon from Cape Germania on the west, the continual movement and breaking of the ice and prevalent open water to westward during the

entire winter and spring decided Mr. Fiala to advance from the east of the island in order to ensure the safety of the supporting parties on their return. The party forced their way northward, the trail bending more to the eastward as they advanced. The ice was very rough—worse than in 1904—and very slow progress was made, as all the men in charge of the sledges had to labour at cutting the trail and then return to assist the teams over the rough road. It was often difficult to find a cake of ice large enough for the small party to camp on; deep snow and numerous open water leads with a high temperature and attendant fog also helped to delay progress. The further north they went, the worse they found the conditions. Time was lost in crossing leads, and for two days and three nights they floated on an ice cake with the temperature at 34° above zero, when it should have been so many degrees below. The ice was in constant motion and cracking under the tents, which necessitated a constant watch while encamped. Realising the fact that the record could not be broken under such conditions, and feeling the pressing necessity for sending food supplies to the parties at Cape Flora and Cape Ziegler, to say nothing of the want of dogs, Mr. Fiala decided to return.

The conditions on the southward march were worse than on the advance, but a fortunate drop in the temperature allowed the party to cross the network of open lanes, and with the wind in their faces and a temperature of 45° below zero, they neared Rudolf Island, reaching Camp Abruzzi on April 1, a saddened company in the realisation that this was the third and last defeat.

On return to headquarters, Mr. Fiala dispatched three men and two sledges to Cape Flora with much-needed supplies, while a second party under Mr. Porter (third in command) was sent south to explore and map the archipelago.

Mr. Fiala arranged that the rest of the party should spend the spring and summer of 1905 in the field, sledging stores south to Camp Ziegler, so that they should be easily accessible if a third winter had to be spent in the Arctic. Meanwhile observatories were erected at Camp Ziegler, and the scientific work was continued without interruption. Early in July a party of six men with dogs, sledges, and boats was despatched to Cape Dillon for the purpose of keeping a look-out for the relief ship, and also to procure walrus, in view of its possible non-arrival.

On the afternoon of Sunday, July 30, the Cape Dillon party returned over the channel ice to Camp Ziegler and brought the good news that the relief ship had arrived off Cape Dillon. The party now got ready for the last sledge trip, as about twenty miles of rather rotten ice had to be traversed before they could get on board. On the march towards Cape Dillon, while crossing a lead in the ice, the fog lifted, and in the haze ahead a large party with two sledges could be seen. This proved to be Mr. Champ with some of the relief party. The homeward journey in the *Terra Nova* has been described above.

As regards the results of the expedition, the party were of course unsuccessful in reaching the Pole, and indeed were some three hundred miles short of the point previously attained by the Duke of the

Abruzzi's expedition. In other respects, however, good results, according to Mr. Fiala, have been obtained. Mr. Fiala says:—"But, although the great question of the Pole is still unsolved, we have brought back *data* which should prove of scientific value, and have explored and surveyed the archipelago from Crown Prince Rudolf Land to Cape Flora, discovering four new channels and three large islands. The result of this will be a new map of this portion of the North Polar regions."

A GREAT GEOGRAPHER: ELISÉE RECLUS.

By Professor Patrick Geddes.

(*Continued from page* 496.)

V.

To know the *magnum opus* is in this case not yet to know the man. It was much to describe the rich variety of nature in all her regions, to unify these into one harmonious survey of the world, almost the Cosmos at which Humboldt himself had aimed: yet all this was but one side of his life's work; the other, henceforth inextricably one with it, was to present and to promote a correspondingly unified conception of man. The geographer, starting as he must from nature and travelling towards man as the latest product of its evolution, was in Reclus' mind increasingly complemented by the sociologist, with his converse perspective, his view of man as of essential interest, the world as but his stage, his background. A goodly stage indeed, as Reclus of all men assuredly felt, and worthy of all the study we can bring to it; yet its complex evolution is but the opening of the plot; humanity is its hero. Hence for Reclus, almost as much as for Comte, the sciences, mathematical, physical, natural, are no longer ends in themselves, but preliminaries. Each, it is true, is justified indeed more than ever as a worthy end to its specialised workers, since henceforth both in principles and generalisations insisted upon as an element in the general scheme of knowledge. But this is to say that all the sciences make up a cosmology, which the comprehensive world-geographer, once Humboldt, or again Reclus, presents in its concrete aspect; and the synthetician, the evolutionist, from Kant to Spencer, seeks to verify yet farther in abstract interpretation. While man is man, he must seek to expand his cosmic knowledge, to deepen his cosmic sense: and, as each of these just named has in his own way borne witness, this cosmic interest ever prepares and makes place for some corresponding enlargement of the human.

In this way, then, the *Géographie Universelle* was naturally supplemented by a *Géographie Sociale*. This has, in fact, not only been in progress for ten years or more since the completion of the former, but its four volumes are said to be practically ready for publication, surely not now to be delayed. For though Reclus could not rival the historic insight of Comte, the imagination of Michelet, the technological mastery

and interpretation of Le Play, the psychology of Taine, the abstract power of Spencer, or the like, he had the advantage of knowing in his own way more of the concrete world than any of these, perhaps than all put together; hence his presentment of sociology may well be looked forward to.

VI.

But a man's life is not much more completely to be expressed in the writing of books than satisfied by much reading of them. It may be enough for the pure thinker to say or write what is in him, but the man of science must also *show* this; hence his diagrams, his instruments and experiments, his maps and globes, his manifold institutes, his vast museums. To the synthetic geographer all these also belong; they are obviously but so many material elements towards building up his and our thought-model of the world. And when, as here, the geographer is at the same time an artist, these many institutes of special science must be combined around and towards and from one central and quintessential museum and institute—that of synthesis. Many may admit this in principle as a desideratum of the world's culture-resources, even where they do not recognise it as one of its direct traditions; but few would be prepared to give definite shape to this conception, and say what manner of edifice this house of synthesis for our own times must be—at most calling up but misty imagery of columned perspective, or mighty dome, or veiled choir. But of the essential character, the concrete content, of this ideal institute, there remained in Reclus' mind no indefiniteness: and, sure enough, plain as Columbus' egg, how else can we concretely express the unity of this great world and all that therein is, otherwise than by its material image? A Globe, that is, and one great enough to show all its essential features in their true relief.

Fascinating as it was to listen to Reclus upon some great theme, as of Alps or Amazons, with his lucid and reasoned exposition, warmed with moral glow, or vivid with poetic fire, it was on his globe that he surpassed himself. He had thought out how this was to be constructed as a comprehensive summary of geodetic and cartographic science; how its panels must be arranged to be kept continually up to date, and thus form the permanent, yet ever-progressive record of geographic exploration and survey; how it should be oriented and revolved, lit and displayed, visited and studied; what should be its accessory resources, galleries, studies, reference-collections, and so on; in short, so as to meet every imaginable requirement of science, special and general, educational and popular. So far this many-sided summary of specialisms, all plain and clear, and with architect's drawings and engineer's specifications to back them, even down to estimates. But then came the vivid phrase which brought all this mass of detail together; and the great globe rose beneath its mighty dome before his and his listeners' inward sight—a universal geography indeed. Instead of a book, were it the best, the latest, here was now the most monumental of museums, the most simple of observatories, the microcosm of the macrocosm itself. Again the description

went on, but now this was no mere scientific model in its institute, but the image, and shrine, and temple of the Earth-Mother, and its expositor no longer a modern professor in his chair, but an arch-Druid at sacrifice within his circle of mighty stones, an Eastern Mage, initiator to cosmic mysteries. Yet once more, with ever nobler look and deepening word, the scene passed anew into the future of its accomplishment, but with an interest no longer solely cosmic, but henceforth primarily human—the unity of the world now the basis and symbol of the brotherhood of man upon it; sciences and arts, geography and labour uniting into a reign of peace and goodwill. With not only intellect but imagination and feeling thus fully aroused, the geographic vision thus rose into the poetic—indeed in no mean measure became the prophetic also.

Yet so far from this Palace of Geography being a mere dream, its realisation very nearly came to pass at the Paris Exposition of 1900, which, even as it was, will best be remembered by its geographic interest —as in fact "l'Exposition des Panoramas." But the times were scarcely ripe; nor indeed was that site and occasion quite appropriate. In these days of great University foundations, one will yet be built or reconstructed around this globe, like Columbia around its library dome. And in the meantime, its mere conception, its design, are great assets of science, and though waiting, ready to be fully realised. Even as it stands, a project of the imagination, a scheme on paper, it is already serving its symbolic purpose, that of marking the advance beyond the passing age of practically unrelated specialist science, with its planless labyrinths of analyses, to the definite advent of that dawning age of synthesis, which the philosophers have so long foretold.

VII.

Of Reclus' extreme political philosophy—his adoption and development of the doctrines of Anarchism—little need here be said: yet, if biography is to be biography at all, whatever may have been its subject's deep and reasoned convictions can no more be passed over in silence than uncritically adopted, denounced, or pitied, according to the sympathies or temper of the particular writer. Yet to discuss these would be beyond our scope—involving both historic antecedents and individual outcomes. Enough to note that here again Reclus' life is of interest as a peculiarly typical one, since it expresses these historic influences with peculiar distinctness. For the humanism of the Renaissance and the private judgment of the Reformation were lived through in his education at school and college, while in his preparation for the pastorate the influences of the Revolution pervaded his whole atmosphere. The Romantic movement of 1830 coincided with his birth; while his entering upon student life in 1848, and on maturity with 1870-71, were, of course, as perfect coincidences as can be imagined of individual and social epochs. Nor must we forget his banishment, repeated at the close of each of these synchronisms.

In every age the revolutionary idealist has thus "eaten the bitter bread of exile," and it is thus little wonder that, whatever their differ-

ences in time and point of view, the ancient prophet or the mediæval poet, the Reformer of Geneva or of Edinburgh, or of later date—all have acquired a certain sternness, an uncompromising character, and each has followed his predecessor, indeed commonly outdone him, in vivid exposition of the deserts and future destiny of his adversaries. It is thus not a little noteworthy, that while by no means failing to preach and prophesy in his turn, Reclus not only kept free from all personal bitterness, even to the immediate authors of his pains, and lived to the last unsoured, and in unfailing gentleness and courtesy to all men, but remained kindly and hopeful, indeed trustful and generous almost to excess. But as the advent of wellnigh every new doctrine in history has been discredited by the violence of fanatic adherents, no inquiry into anarchism can avoid bringing up some of the extremest types of our modern degenerates, and raising all the questions of disease, folly, vice, and crime. Yet assuredly not less than with each preceding historic movement of individualism, we are also confronted by the problems of the psychology of genius, and this both in action and in theory; and this again in science and in philosophy, and even in religion. It is of course these elements, not fatuous gunpowder plots and futile criminals, that have made the approach of each new movement in history seem so formidable to its predecessor.

It would be to ignore the facts of history and biography, and the analogous cases of other times and countries as well, and with them all that is noblest in human nature, were we to attempt to explain that renascence of France since 1871, of which the English-speaking world has as yet known too little, as other than fundamentally moral. Liard and Lavisse in their great work of university regeneration are surpassing all British and even all American initiatives—the regenerative process is, indeed, comparable only to that of Germany after its humiliation at Jena by the great Napoleon. Picard in his Expositions, Pasteur in his Institute, and Duclaux in his laboratory; Zola in his kindred studies of moral fermentations; Lacaze-Duthiers in his zoological stations and with his student sons—in short, all the best men of education, letters, science; and with them the engineers, the impressionist or the decorative painters, the idealist sculptors—each and all had said to himself and to his fellows, "Il faut refaire la patrie." But for Reclus—twice cast out from her, disillusioned from each and all the successive utopias of his youth, with the defeat of national and of popular resistance to invasion sore upon him, and, worst of all, the collapse and ruthless quenching in blood of what, with all its failures and faults, had yet been the noblest renewal of civic idealism since those great communes of the middle age of which it sought to renew the life and name—these sources of hope and inspiration were no longer open. At this time, one of widespread night of the soul, too many of the strong lapsed into bitterness and despair, and of the weak into indifference or evil; but some, and with them Reclus, rose to a higher idealism and resolve than before. We have already seen how he now settled to his geographic life-work, and imagined its stupendous and still unfulfilled monumental expression: we see him also not only conceiving his social geography, but conceiving its correspond-

ing idealism also in Humanity as Individual. Comte had subordinated the individual to humanity, as now in our day Tolstoi would do yet more; but to Reclus, as later to Nietzche, it is in the individual that humanity must find its expression. In this vivid idealism of the species and its type he, as indeed this whole school of thinkers, no doubt too much lost sight of the intermediate categories of the city and state, of the nation and empire, of the unity of language, of occidental and oriental civilisations—in short, of the whole gradated social framework in which we find support, albeit too often also our limitations; and these it is for the social geographer to accept, but to gradate between this limited individualistic outlook, and the universal, the humanistic one, too vast and vague for ordinary uses. This in later years Reclus came fully to recognise, as proves his cordial collaboration in this matter with the writer—whose "Outlook Tower" of social and regional geography he warmly adopted as the human complement and legitimate adjunct to his own cosmic presentment of the great globe, so that for a time both sought erection in common. How far, too, his social standpoint had passed beyond the phase of negation represented by Bakounine, his forthcoming *Social Geography* will show. In the meantime, this constructive progress may also be judged from the kindred writings of his constant friend and fellow-thinker, Kropotkine (see his *Fields, Factories, and Workshops*, or his *Mutual Aid*)—the scientific nature-description and the cosmic emotion which predominate in the work of the older geographer being thus fitly supplemented by the practical and geotechnic impulse and the ethical glow of the younger.

That the central thought, however, which seemed so dangerous in Reclus and his school is nowadays becoming a more familiar matter, almost one of plain everyday prose, and that it is being plainly put by younger men of science to their peers, may be perhaps most clearly seen by the following quotation from one[1] whose world-wide specialist eminence is yet matched by his synthetic range and insight:—

"We apply the same word *law* both to the regularities of the natural processes and to the arbitrarily influenced actions of mankind. The great thing which the moral and political law-makers have done is *that they have made it possible in certain fields of human actions to make predictions.* Since they did not know the internal causes upon which such actions are dependent, they were obliged to make such external rules or laws in the *juristic* sense. These agree more or less with the unknown psychological and biological laws which are applicable to the phenomena in question. The better they have agreed, the more lasting have been these laws, and the greater and more powerful have been the law-makers. Thus every political and moral organisation is dependent on biological conditions; and these fields are evidently those which are destined to be irresistibly conquered by science."

---

[1] Ostwald, "The Relations of Biology and the Neighbouring Sciences." *University of California Publications: Physiology*, Vol. i. No. 4. Berkeley, October 1903. (An Address delivered at the Dedication of the Physiological Laboratory of the University of California by Wilhelm Ostwald, Professor of Physical Chemistry at the University of Leipzig.')

The summary account of M. Reclus' life, referred to on p. 492, is as follows:—

1830.—Jacques Elisée Reclus was born at Sainte-Foy-la-Grande, Gironde, on the 15th March 1830, the second son of a Protestant pastor, and one of a family of twelve children, several of whom have obtained prominence as authors, etc.

1831.—In 1831 the family removed to Orthez, Basses Pyrénées, where his father had been appointed pastor of a nonconformist church. From 1831 to 1840 Elisée lived at Orthez and Laroche-Chalais, Dordogne, the abode of his maternal grandmother.

1840.—From 1840 to 1842 he was at Neuwied, Rhine Provinces, in a boarding-school kept by Moravian Brothers; and from 1842 to 1848 at the Protestant College of Sainte-Foy.

1848.—During the session of 1848-49 he studied at the Theological Faculty of Montauban.

1849.—From 1849-50 he was at the University of Berlin, nominally to study theology, but mainly working at geography under Karl Ritter, earning his living meanwhile by giving poorly-paid lessons.

1851.—In 1851 he left Germany, crossing France on foot from Strasburg to Orthez in company with his elder brother Elie and their dog.

1851.—On the *Coup d'État* of December 1851 both brothers went to London and afterwards (1852) to Ireland, where Elisée earned his living by teaching, and had some experience of farming.

1853.—This was the beginning of the six years of continuous travel which formed him as a geographer. The two years 1853-54 were spent in North America (New York, New Orleans, where he tried his hand at any kind of occupation that offered, writing, amongst other things, for a medical journal edited at New Orleans), and the two following (1855-57) in South America, where in Columbia he again tried farming.

1857.—In 1857 he returned to France and published his *Histoire du Sol de l'Europe* in the Revue Philosophique.

1858.—After his marriage he lived in Paris from 1858 to 1870, often with his brother-in-law, Alfred Dumesnil, at Vascœuil.

1859.—First articles in the Revue des Deux Mondes: *le Mississippi et ses Bords*; *la Nouvelle Grenade*; and, in the Bulletin de la Société de Géographie de Paris, an article entitled *les Fleuves*; later a translation of Karl Ritter's *Configuration des Continents*.

1860.—*De l'Esclavage aux Etats-Unis*—four articles in the Revue des Deux Mondes; *Guide en Savoie* for the Joanne series of Guide Books; *Excursions en Dauphiné* for the journal Tour du Monde.

1861.—Articles in the Revue des Deux Mondes and the Revue Germanique.

1862.—Articles in the Revue des Deux Mondes and the Bulletin de la Société de Géographie de Paris; Joanne Guide Books.

1863.—Joanne Guide Books.

1864.—Revue des Deux Mondes; Annales des Voyages; translation by Elie and Elisée Reclus of a work by Sargent on *les Etats Confédérés et l'Esclavage*.

1865.—Revue des Deux Mondes; Annales des Voyages; translation of a work by Walker on *la Dette Américaine et les Moyens de l'acquitter*.

1866 and 1867.—Revue des Deux Mondes; article on *John Brown* in la Co-opération; translation of a work on *le Brésil et la Fermeture des Fleuves*.

1868.—La Terre, 1st vol.: *Les Continents* (Hachette); Revue des Deux Mondes; Revue Politique; Almanach de la Co-opération.

1869.—La Terre, 2nd vol.: *L'Ocean; Introduction au Dictionnaire des Communes de France; Histoire d'un Ruisseau.*

1870 and 1871.—Franco-Prussian War and Commune. Serves in the National Guard and in the Company of Aeronauts under M. Nadar. Plateau of Châtillon. Fortress prisons. Council of War condemns him to transportation.

1872.—Commutation of sentence. Arrival in Switzerland. Lugano.

1873.—Articles on general geography in the Bulletin de la Société de Géographie de Paris, in the République française, la Gironde, and la Réforme. *Quelques Mots sur la Propriété* in the Almanach du Peuple; *A Mon Frère le Paysan.*

1874.—Goes to live at Tour de Pelz on the Lake of Geneva. Articles in the République Française and the Tour du Monde.

1875.—Stays at Vevay, but shortly after settles at Clarens. Lectures at Geneva on the History of the Mediterranean; articles in the Globe de Génève and the République Française. First volume of the "Géographie Universelle"—*L'Europe Méridionale.*

1876.—Second volume of the Géographie Universelle—*La France*; various short articles.

1877.—*L'Europe Centrale*, 3rd vol.

1878.—*L'Europe du Nord-ouest*; articles in the Revue Lyonnaise, Le Travailleur, and La Marseillaise.

1879.—*L'Europe du Nord.*

1880.—*L'Asie Russe. Evolution et Revolution*, and other articles. *Histoire d'une Montagne*; article on "*Rivers*" in an American encyclopædia.

1881.—*L'Asie Orientale.*

1882.—*L'Inde et l'Indo-Chine*; geographical and other articles.

1883.—*L'Asie Intérieure.*

1884.—*L'Afrique Septentrionale.* Minor articles.

1885.—*L'Afrique Septentrionale.* Minor articles.

1886.—*L'Afrique Occidentale.*

1887.—*L'Afrique Méridionale.* Articles in various journals.

1888.—*L'Océanie.*

1889.—*L'Amérique Boréale*; articles in la Société Nouvelle. Preface to Metschnikoff's book: *La Civilisation et les grands Fleuves Historiques.*

1890.—Leaves Switzerland and goes to live at Sèvres. *Les Indes Occidentales.*

1891.—*Les Etats-Unis.*

1892.—*L'Amérique du Sud.* Preface to Kropotkine's book: *La Conquête du Pain* ("Fields, Factories, and Workshops").

1893.—Removes to Bourg-la-Reine in consequence of annoyances by the police. Edinburgh. Lectures at the Edinburgh Summer Meeting.

1894.—Appointed Professor of Comparative Geography at the Université Libre, Brussels. Elisée settles there and begins a course of lectures on *les Milieux* at the Loge des Amis des Sciences. Articles in the Contemporary and other reviews. Lectures on *l'Anarchie* in Brussels and other towns. Foundation of the Université Nouvelle. He is awarded a medal by the London Geographical Society on the completion of his Géographie Universelle.

1895-96.—*Projet de Construction d'un Globe Terrestre* on the scale of 1 : 100,000; articles in various journals. Lectures at the Edinburgh Summer Meeting and elsewhere. Lectures during the session 1896-97 at the Université Nouvelle: *Iran, Touran et Mésopotamie.* Lectures at the Temple de la Science at Charleroi.

1897.—Articles in the Magazine International, la Société Nouvelle, l'Almanach de la Question Sociale, etc. Session 1897-98, lectures at the Université Nouvelle on *les Sémites.*

1898.—Articles in l'Humanité Nouvelle, Atlantic Monthly, etc. Lectures at the Maison du Peuple, Brussels, at the Société de Géographie, d'Anvers, Royal Geographical Society. Session 1898-99, lectures at the Université Nouvelle on *L'Egypte et les Egyptiens.*

1899.—Articles in l'Humanité Nouvelle, les Temps Nouveaux, etc.

1900.—Numerous articles. Paris Exhibition.

1901.—*L'Afrique Australe* (in conjunction with Onésime Reclus); articles in Die Waage, la Réforme alimentaire, etc. Prefaces to various works; *l'Enseignement de la Géographie.*

1902.—*L'Empire du Milieu* (in conjunction with Onésime Reclus); articles in l'Humanité Nouvelle, l'Education Sociale de Lyon, les Temps Nouveaux, la Revue. Lectures at Antwerp.

1903.—Articles in various journals. Prefaces. Lectures at Royal Geographical Society and at the Société d'Astronomie, Brussels.

1904.—Articles in l'Humanité Nouvelle, la Revue, les Temps Nouveaux. Death of his brother Elie.

1905.—Articles in l'Insurgé, les Temps Nouveaux, la Revue, etc. *L'Homme et la Terre*, Part 1st, appears 15th April. Short Life of Elie Reclus.

1905.—July 4.—Death at Thourout, near Bruges, from heart disease.

GEOGRAPHICAL NOTES.

Asia.

China and Tibet.—The report of Mr. A. Hosie, His Majesty's Consul-General at Chengtu, on a journey to the eastern frontier of Tibet has been published as a Parliamentary paper [China, No. 1, 1905, Cd. 2586]. Mr. Hosie left Chengtu on July 28, 1904, and reached the frontier of the Chinese province of Szechuan and Tibet on September 16. He arrived in Chengtu again on October 28. The most interesting part of the report is that dealing with the trade between the city of Ta-chien-lu and Tibet. Brick tea is the principal export to Tibet, and the principal import is musk. A large map giving Mr. Hosie's itinerary is appended to the report.

The New Province of Bengal.—In connection with the note on this subject in our last issue (p. 496), attention may be drawn to the fact that the India Office have issued under the heading "East India (Reconstitution of the Provinces of Bengal and Assam)" a Parliamentary paper [Cd. 6258] containing a letter, addressed on December 3, 1903, to the Chief Secretary to the Government of Bengal by the Secretary to the Government of India, and the text of the resolution of the Government of India in the Home Department, dated July 19, 1905, on the subject of "the redistribution of certain of the territories of the Eastern and North-Eastern Provinces of India, notably of Bengal and Assam."

The resolution sets forth the details of the changes decided upon, and explains the nature of the amendments introduced since proposals for dealing with the question were originally made public by the Governor-General in Council in December 1903. The resolution states that the criticism, which was invited, and which was freely and usefully bestowed upon the original proposals, justified substantial alterations and led in the end to the abandonment of that portion of the scheme which contemplated the transfer of certain territories from Madras to Bengal and of the greater part of Chota Nagpur from Bengal to the Central Provinces. Reasons of administrative expediency stood in the way of the first-named change, while the second was abandoned mainly from commercial considerations. It has, however, been decided to hand over from Bengal to the Central Provinces the five native States of Jashpur, Sarguja, Udaipur, Korea, and Chang Bhakhar, forming a solid block of territory with a Hindi-speaking population. On the other hand, the Sambalpur district (with the exception of Chandarpur, Padampur estate, and Phuljhar zamindari) and the five Uriya-speaking States of Patna, Kalahandi or Karond, Sonpur, Bamra, and Rairakhol are to be transferred from the Central Provinces to the Orissa division of Bengal. Linguistic considerations are the main reasons for this transfer, and it is in contemplation to protect the interests of the chiefs affected by appointing a European political officer to take charge of the entire group of Uriya-speaking States.

Coming to the most important part of the scheme to which the Secretary of State has given his sanction, the resolution points out that the original proposals in respect to Eastern Bengal and Assam were found, in the course of the discussion to which they gave rise, not to be sufficiently comprehensive to justify in the new province the institution of so highly-organised and fully-equipped an administration as to satisfy the feelings of the Bengal people, alarmed at the possible deprivation of privileges which they had for long enjoyed. Accordingly, in addition to the transfer of the Chittagong division and the eastern districts of Dacca and Mymensingh, it was decided to add to the new province the districts of Rajshahi, Dinajpur, Jalpaiguri, and Malda, and the State of Kuch Behar. "These additions," continues the resolution, "were thought by the Government of India to be justified on the grounds that they would constitute a new province with a population of over 31 millions, while leaving Bengal with little more than 54 millions; that they would provide a clearly-defined western boundary corresponding with well-recognised characteristics, both geographical, ethnological, social, and linguistic; that they would concentrate in a single province the typical Mahomedan population of Bengal, for whom Dacca would furnish a natural capital; that the whole of the tea industry (with the exception of the Darjeeling gardens) and the greater part of the jute tracts would thus be brought under a single Government; and that the long-established divisional areas would thereby remain undisturbed." The enlarged scheme was cordially accepted by the Governments both of Bengal and Assam, and on the suggestion of the Chief Commissioner of Assam it was decided to create a new Commissionership out of the Surma Valley districts and Manipur, at present under his own direct

control, thus raising the number of divisions in the new province to five, the three Bengal divisions transferred being those of Chittagong, Dacca, and Rajshahi. Darjeeling, which is situated in the latter division, will, however, remain with Bengal, in order to maintain associations which are highly valued in both areas. The Lieutenant-Governor of the new province will have his capital at Dacca, with subsidiary head-quarters at Chittagong. The province will comprise a population of 31 millions, of whom 16 millions are Mahomedans and 12 millions Hindus. It will possess a Legislative Council and Board of Revenue of two members, and the jurisdiction of the High Court of Calcutta is left undisturbed. Bengal will have a population of 54 millions, of whom 42 millions are Hindus and nine millions Mahomedans. In short, the territories now composing Bengal and Assam will be divided into two compact and self-contained provinces, the largest constituents of each of which will be homogeneous in character, and which will possess clearly-defined boundaries and be equipped with the complete resources of an advanced administration.

Geology of Upper Assam.—Mr. J. Malcolm Maclaren has recently published a paper on this subject (*Records Geol. Survey, India*), in which he points out that the region is a great plain, lying 320 to 500 feet above sea-level, and bounded on the north-west by the eastern Himalayas, and on the south-east by the Patkai ranges, while the head of the valley is closed in by the crystalline and metamorphic rocks of the Miju ranges. On the Patkai and Himalaya ranges Upper Tertiary sandstones occur at a considerable height, up to 6000 feet indeed, but they have not been observed anywhere on the heights of Miju. Mr. Maclaren draws attention to the general uplifting and reversed faulting of the Tertiary rocks on either side of the great plain, and to the deflection in the trend of the Patkai range where it abuts against that of Miju. These features are attributed to earth stresses during the formation of the mountains. The author concludes that the Patkai and Himalayas, in their later growth at least, are of contemporaneous development, and that both are orographically and geologically distinct from the great meridional mountain-system of Upper Burma, Tibet, and Western China.

Africa.

The Alexander-Gosling Expedition.—Captain Gosling, of the Alexander-Gosling Expedition in Northern Nigeria, has sent a very interesting collection of fishes from Lake Chad and the Shari river to the Natural History Museum at South Kensington. The consignment has recently been received, and an examination of the fishes shows that, without a single exception, all the specimens belong to species which occur in both the Nile and the Niger. This fact is of interest in that it tends to give support to the idea held by many ichthyologists of a former communication in times geologically recent between the river systems of the Nile and the Senegal-Niger. Lake Chad probably repre-

sents the dwindling remains of a series of lakes by which this communication was effected. The present collection of fishes is stated to be the first ever obtained from Lake Chad and the rivers flowing into it, and it realises in a very striking manner the anticipations of ichthyologists.

America.

The Phytogeography of the Bahamas.—In *Science* (xxi. 538) Dr. N. L. Britton gives an interesting account of a botanical cruise to these islands. The group includes over 2700 islands, keys, and rocks, all of which are built up of coral limestone. The islands are so scattered that there is considerable variation in temperature and rainfall. Owing to the porous nature of the material there are no known permanent fresh-water streams, although there is a considerable number of salt-water creeks of considerable size. Occasionally there are fresh-water ponds and marshes, mostly of small size. The botanical novelties found were mostly obtained from these ponds and marshes. Salt-water ponds which rise and fall with the tide are abundant and sometimes of large size.

There is very little soil in the islands except that known as "red land," which occurs in the bottom of sink-holes and locally in swales, and the "white land" formed from the crumbled rock, either disintegrated *in situ*, or accumulated as sand-dunes. These two formations represent practically all the arable land of the islands. A very remarkable feature of the islands is the abundant and almost impenetrable thicket which seems to grow directly out of the rock.

Geologically the Bahamas are of recent origin, for the uplift to which they owed their origin has been ascribed to the late Tertiary. Their flora is therefore modern.

This flora proves to be of southern derivation, a large number of the known indigenous species being common to the adjacent and older islands of Cuba and Hayti, while many others are closely related to plants from these islands. The chief agents in the introduction and distribution of the plant population are migratory birds, supplemented by winds and currents. Notwithstanding the geologically short period that the Bahamas have been above the sea, they have witnessed the evolution of numerous species, there being many endemic species known and many more which will be described in consequence of the recent expedition.

The Physiography of the Adirondacks.—A paper on this subject was read recently by Mr. J. F. Kemp before the New York Academy of Sciences (cf. *Science*, vol. xxi. p. 988). The Adirondacks cover some 10,000 square miles, and, except for the White Mountains of New Hampshire and the Blue Ridge of North Carolina, are the loftiest summits east of the Black Hills of South Dakota. They are metamorphosed pre-Cambrian sediments and eruptives with a surrounding fringe of Paleozoics beginning with the Potsdam and ending with the Utica, except for the Glacial drift. The eastern portion is mountainous, the

western a high plateau which slopes to Lake Ontario. Three peaks exceed 5000 feet. The general profile is serrate, but there is great variety of shape. There are two contrasted types of valleys. One type, doubtless an instance of greater geological antiquity, presents gentle slopes and great maturity of form. Its members run east and west, and north and south, and are occupied in some cases by the larger lakes.

The second type is more recent, and is due to faulting. The valleys have on one or both sides precipitous escarpments. The cliffs run north-east and south-west, or north-west and south-east. A third series of breaks running nearly due north is also at times in evidence. The faults are most often the result of differential movements causing even a marked sheeting of the rocks. The faults run out into the Paleozoic areas, and are shown with diagrammatic distinctness.

The problem of the drainage is of special interest. All the waters go ultimately either to the Hudson or the St. Lawrence. The courses of the large streams follow sometimes the older type of valleys, sometimes the later. Barriers of drift have often driven them from their old lines across low, pre-glacial divides into new ones. The courses of the Hudson and Onondaga are particularly striking illustrations, each exhibiting one or more marked bends to the eastward.

Polar.

Ancient Antarctica.—In a recent issue of *Nature* (vol. lxxii. p. 244), Captain F. W. Hutton publishes a letter on this subject, in which he gives it as his opinion that if a former extensive Antarctic continent existed it must have been a very long time ago. As the subject is one of considerable interest in connection with the results of Antarctic exploration, we quote Captain Hutton's letter in full:—"That the continent existed a long time ago is," he states, "proved by the great differences that exist between the floras and faunas of the three great southern continents. These differences are much greater than those between the floras and faunas of North America and Eurasia, and consequently the land connections must have been broken up in the south long before they were in the north. We infer the former existence of an Antarctic continent from the existence of granite and foliated schists in South Victoria Land, and evidence that it was formerly connected with northern lands is found in the existence of flightless insects living there in the few patches of mosses and lichens which manage to struggle through the winter. These insects are not flightless through degeneration, but belong to an order which never possessed wings. It is very improbable that the ancestors of these minute insects were carried or blown to where they are now found; they must have travelled to their present positions by land. That is, the Antarctic continent south of New Zealand and Patagonia must, at some time or other, have joined on to northern lands.

"In the islands of the Antarctic Ocean we have further evidence of a former land connection in the earthworms belonging to the family

Acanthodrilidæ, which are characteristic of Antarctic regions. A spider also lives on Bounty Islands, which is closely related to one from Cape Horn. But spiders seem to have special facilities for crossing barriers; and the insects found on Bounty Islands are all related to New Zealand forms. I do not include here the evidence of the plants of the Antarctic islands, for most plants do not require that the land should be actually continuous to enable them to spread.

"But if the flightless insects and the earthworms imply a former connection with northern lands, that connection must have been a very long time ago, before the spread of insects and angiospermous plants over the world—that is, not later than the Jurassic period. If there had been any land connection in Tertiary times, there would have been a much greater mixing of the animals and plants.

"It is evident that the flora, and perhaps the fauna, of Antarctica were formerly much richer than at present, as is proved by the fossil plants of South Victoria Land; and it is also probable that both fauna and flora were killed off by an increasingly rigorous climate. It is not necessary to assume a former glacial epoch for this, for higher plants and animals could hardly resist the present climate, and there is no palæontological evidence of a period of greater cold than now having ever existed in the southern hemisphere. On the contrary, the biological as well as the palæontological evidence is against the idea. For the much-modified plover, Chionis, and the insects of Kerguelen Land, as well as the remarkable flora of the Antarctic islands, show that the islands could not have been covered with ice for a very long time.

"The relations between the avifaunas of Australia and South Africa are much closer than exist between those of Australia and South America; and this is just what we should expect if the ancestors of the present birds had spread down from the north under the present condition of land and sea, for the land connection between Australia and South Africa is far more intimate than that between the former place and South America. But the contrary is the case with the mammalia, some of the tortoises, snakes, frogs, some of the freshwater fishes, a large number of insects, and the family Cryptodrilidæ of earth-worms. This implies that at some former time a closer connection existed between Australia and South America than between Australia and Africa. The question is, was this connection by means of an Antarctic continent, or was it by a Pacific continent?

"The principal objection to the southern route is that the connection between Australia and South America is shown by a number of subtropical animals—such as *Osteoglossum* and *Ceratodus*—none of which have left any trace of their passage through New Zealand. We cannot suppose that New Zealand was disconnected at the time from the Antarctic continent, for it also has distinct relations with South America, but for the most part by means of different animals from those which show the Australian connection. If the connection was in either the Cretaceous or the Eocene period, we might suppose that the climate was warm enough for the passage of the subtropical animals by the Antarctic route, but, if so, why are there no traces of marsupials and

South American frogs in New Zealand? If, on the other hand, we suppose the ancestors of these animals to have crossed from Australia to South America by a South Pacific continent, we can understand how the subtropical forms would not have come so far south as New Zealand, while the New Zealand forms would have crossed at a higher latitude. In favour of this we have a member of the Iguanidæ in Fiji, as well as the evidence of the land shells of Polynesia, which are not a collection of waifs and strays, but form a distinct group of a very early type, which, however, has not yet been found in South America.

"We still have to consider the floras and the marine faunas of the Antarctic islands. Here we see a number of birds—such as cormorants and gulls—as well as fishes and plants, which could hardly spread round the world under the present conditions of land and water. That this spreading was a comparatively late one is proved by the near relations between the species. But if there had been continuous land at the time, land animals would have spread with the marine ones. It is therefore necessary to suppose that this last spreading of species in Antarctic latitudes was by means of a number of islands. Probably this was in Pliocene times, if we may judge by the amount of differentiation which has taken place since then.

"I therefore conclude that the hypothesis which best explains the phenomena is the following:—

"(1) That in the Jurassic period an Antarctic continent existed which connected South America with New Zealand and South Africa.

"(2) That this continent sank in the Cretaceous period, and that Antarctica has never since been connected with northern lands.

"(3) That in the Cretaceous or early Eocene a Pacific continent connected New Guinea and New Zealand with Chili.

"(4) That this land sank at the close of the Eocene.

"(5) That in the Pliocene a number of islands existed in the Antarctic Ocean which have since then disappeared."

General.

Tristan d'Acunha.—In connection with the article on this subject which recently appeared in this *Magazine* (p. 301), our attention has been called to a short but interesting account of this same island, which, under the title "The Smallest Colony in the World," was contributed to *L'Italia all' Estero* (No. 2, 1901) by Signor A. Faustini. This paper, of which a reprint has been sent to us by the author, describes concisely the physical features and government of the island, enumerates its population at different times, and briefly traces its history from its first discovery down to the present day.

Another paper on the same group which may be mentioned is one by Mr. E. H. L. Schwarz, entitled "The Rocks of Tristan d'Acunha," which appears in the *Trans. South African Philosophical Society* (vol. xvi. p. 9). From his examination of a series of rock specimens from the archipelago, the author concludes that the group, although volcanic, stands upon a continental ridge. He believes that a continental ridge

formerly crossed the Atlantic from Africa to South America, probably extending from Cape San Roque through St. Paul's rocks to Sierra Leone on the north, and from the south of Brazil through Tristan d'Acunha to the Cape of Good Hope on the south.

Exploration of the Indian Ocean.—A letter in *Nature* for August 10 gives some account of the progress of the *Sealark* Expedition (cf. this *Magazine*, p. 337). The letter is from Mr. Stanley Gardiner, the leader of the expedition, who states what the vessel left Colombo on May 8, and reached a latitude south of the Maldives on May 14. Here the party commenced sounding in view of the possible existence of a bank between this group and the Chagos, as indicated by the soundings of the *Valdivia* Expedition. The soundings showed a depth of more than 2000 fathoms between the two groups. The depth increases from the Maldives and Chagos towards the centre of the passage between, but in this position there would seem to be a broad flat, extending along the line of latitude with a depth of 2000 to 2150 fathoms. "Both east and west the depth probably increases gradually to 25,000 fathoms or even more, but one obviously cannot build up any views of a possible former connection of the Chagos and Maldives on such a slender basis."

On the way down the party took samples of the sea-water and of the pelagic fauna. Series of hauls were also taken with the Fowler and Wolfenden closing nets, and it was found that of the two the Fowler was the more suitable to the conditions prevailing in the region under consideration.

On May 19 the party anchored at Île de Dimant, Peros Banhos Atoll, but on account of the prevalence of the SE. trades were obliged to move on to the Salomon Atoll on May 22. On the following day a camp was made on this atoll, which is of small size (five miles long by three and a half broad) and closed on all sides by a surface reef, save for a small passage to the north. At the date of the letter (June 6) Mr. Gardiner was still at this atoll, which was being fully worked out by the members of the party, but he expected to move on to Peros Banhos in the course of a few days.

Commercial Geography.

Sierra Leone Government Railway.—Reuter's Agency states:—News has been received that the last section of the Sierra Leone Government Railway from Bo to Baiima was handed over to the Government of the colony on July 31, with the exception of one large bridge across the Moa river, which was to have been completed on the 12th inst. This section is 87 miles in length, and completes the construction of the railway for the present. The gauge of the railway is two feet six inches, and now extends from Freetown, the fine natural harbour of the West Coast of Africa, to near the frontier of Liberia, a total distance of 225 miles. The railway passes through somewhat rugged country, and consequently includes a considerable number of

large works. There are numerous steel viaducts in the first 20 miles, while the rivers further up country require important works, amongst which may be mentioned the bridge over the river Ribbi, at 39 miles, 662 feet in length; the Taia bridge, at 106 miles, 589 feet long; Sewa bridge, 160 miles, 718 feet long; and the Moa bridge, at 213 miles, 640 feet long. The district of the colony now tapped was practically unexplored ten years ago, but is now found to possess a considerable population of natives industrially inclined: while extensive forests of oil palms, hitherto untouched, will now contribute natural produce to the exports of the colony. The railway has been carried out under considerable difficulties inseparable from the construction of large works in an unhealthy climate.

The Shanghai to Nanking Railway.—According to an article in the *Times*, construction work on this railway is actively proceeding, and the first section of the line is expected to be opened before the close of the year. The line to Nanking, *viâ* the provincial capital of Suchow, is approximately 200 miles long, and runs through flat country, intersected by many creeks, and covered as far as Chinkiang by innumerable graves. From Chinkiang the line runs along the slope of the hills which lie close to and parallel with the Yang-tse. The presence of graves along the course of the proposed line has been a cause of great difficulty and delay, for compensation has to be paid for the removal of each grave. According to the present expectations of the engineers, the first section of the line to Naziang will be opened in the present month (October); the second section, to Quinsan, at the end of the year; the section to Suchow in March 1906, and to Wusieh, the great silk district, in June. Commercially, great results are hoped from the opening of the line, which traverses very well-populated districts. Indeed, between Shanghai and Suchow the railway passes a town or village every 500 feet within a quarter of a mile from its centre line; in other words, no fewer than 549 centres of rural population have been located on the surveys of the 52 miles in this section.

NEW BOOKS.

EUROPE.

Twenty Years on Ben Nevis. By Wm. T. Kilgour. Paisley: Alexander Gardner. Pp. 154. *Price* 2*s.* 6*d.*

This "Brief Account of the Life, Work, and Experiences of the Observers at the highest Meteorological Station in the British Isles," to quote the expanded title of the volume, is the work of one who, though not a member of the regular staff, had probably better opportunities than any other for becoming acquainted with the matters on which he writes. He himself not unfrequently did duty on the summit for some official observer who was taking a needed holiday; and his familiarity with the Ben in all its varied moods fits him in a special manner for the task he has undertaken. The story of the great Ben Nevis Experiment,

carried out under the guidance of a body of directors resident mainly in Edinburgh, begins fittingly with an account of the almost daily visits of Mr. Clement Wragge during 1881-82. The Observatory itself was opened in 1883; and thereafter were taken the hourly readings, without intermission for twenty-one years, of the temperature, pressure, wind force, rain or snow fall, on the highest point of the British Islands. Mr. Kilgour gives a good account of the scientific routine work on Ben Nevis and of the various types of weather—good, indifferent, and terribly bad—encountered there. Some thrilling experiences are recorded, and some particularly interesting extracts from the log-book. The book is not, however, all serious. It gives a glimpse at the summer visitors who crowded to the summit when the weather seemed propitious, only to find in many cases a world of cloudland instead of a far-reaching view. Some of the poetic efforts of these visitors are extracted from the visitors' book, and are amusing enough. Some well-chosen illustrations give much interest to the work; and an ingenious chart shows the panoramic view as seen from the top on a fine clear day. Mr. Kilgour deserves the thanks of all interested in the Ben Nevis Scientific Experiment for his timely, well-written little volume. We can hardly expect it to convert to their right mind those in whose hands lies the organisation of our national system of meteorological observations; but it cannot fail to educate public opinion.

Baedeker's Konstantinopel und Kleinasien. Mit 9 Karten, 34 Plänen und Grundrissen. Leipzig: Karl Baedeker, 1905. *Price M.*6.

The title of this new "Baedeker" scarcely gives an adequate idea of the contents of the volume. It might almost be called "Baedeker's Near East." Commencing with Buda-Pest, it carries the traveller on to Belgrade, Nisch, Sofia, Adrianople, Bucharest, Odessa, Saloniki, and Constantinople; thence it crosses to Asia Minor, and from Brussa to Angora and Konia. The west coast is then dealt with, beginning at Troy and proceeding to Smyrna, the ruins of Ephesus, Pergamos, Samos, Kos, and many other sites of living interest to classical students. Needless to say, the compilation of this volume must have involved much labour and research; nevertheless it appears to be done with Baedeker's well-known thoroughness. Although it is to be regretted that there is not an English edition, yet probably most of the travellers making such a tour will be familar with German.

Baedeker's Greece. With 11 Maps and 24 Plans. Third Revised Edition, 1905. Leipzig: Karl Baedeker. London: Dulau and Co. *Price M.*8.

Baedeker's Switzerland. With 63 Maps, 17 Plans, and 11 Panoramas. Twenty-first Edition, 1905. Leipzig: Karl Baedeker. London: Dulau and Co. *Price M.*8.

The third edition of Baedeker's *Greece* has been specially revised and enlarged to incorporate the important results of recent archæological research. Improved means of communication for travellers have also necessitated a revision of the routes. In addition to the revision of the maps, several new ones have been added.

In Switzerland there do not appear to be any special new features, but the volume has received the usual revision to date.

Grisons (Bündner) Oberland: an Illustrated Handbook. By Dr. Chr. Tarnuzzer. Zürich: Art. Institut Orell Füssli, 1905.

Really good and reliable illustrations are of great value in a guide-book, especially in helping one to select a resort or to plan a tour. The *Orell-Füssli Handbooks* are not only admirably illustrated, but appear to be most thoroughly done in every respect, dealing with all aspects of interest, natural and historical.

ASIA.

The World of To-Day: a Survey of the Lands and Peoples of the Globe as seen in Travel and Commerce. By A. R. Hope Moncrieff. Vol. ii. London: The Gresham Publishing Company, 1905. Pp. 266. *Price* 8*s. net.*

In this, the second, volume the countries of Southern Asia, with the exception of India and Ceylon, are described. A very readable account is given of these countries, their fauna and flora, and their inhabitants, with their manners and industries. For the geographer the information is perhaps too sketchy, especially as regards physical geography, but for the general reader there is probably sufficient detail. The volume is well provided with maps and clear illustrations, which show the scenery, racial types, costumes, etc. A work bearing the date 1905 should have taken notice of the Franco-Siamese treaties of 1904, whereby the French boundary on the Gulf of Siam is advanced so as to include Krat, and Chantabun has been restored to Siam. The diagrams in the Commercial Survey might be improved. For instance, the diagram showing the production of tea, etc. in Java, has no scale, and is not accompanied by figures indicating the quantities.

AMERICA.

La Cordillera de los Andes entre las Latitudes 46° i 50° S Luis Riso Patron, S., ex-Injeniere Jefe de la Segunda Sub-comision Chilena de Limites con la República Argentina. Santiago de Chile: Imprenta Cervantes, 1905. Pp. 235.

The Chilian Government is publishing the results of the work of the surveyors who have examined the region of the boundary towards the Argentine Republic. One volume dealt with the cordillera between latitudes 30° 40′ and 35°, and now the above volume has been issued describing the country of the great lakes, Buenos Aires, Viedma, San Martin, etc. Besides the work of the commissions, a general description is given of the orography, hydrography, and meteorology of the country, and the diaries of several travellers in Patagonia. Naturally there are full tables of the astronomical co-ordinates obtained and the heights of the chief peaks; nor have the fauna and flora been neglected. The work is embellished by photographs, and is provided with a map and a sketch map showing the new frontier and the watershed.

GENERAL.

Topographie Pratique de Reconnaissance et d'Exploration, suivie de notions Élémentaires Pratiques de Géodésie et d'Astronomie de Campagne. Par E. de Larminat. Paris: Henri Charles-Lavauzelle. n.d. Pp. 343. *Price* 7 *frs.* 50.

This book is intended as a guide to officers who are stationed in remote districts of unexplored countries, and who may be disposed to spend their leisure time in surveying their neighbourhood and the localities they may visit in the exercise of their duties. Captain de Larminat has had practical experience in Africa, and knows thoroughly the kind of instruction most needed by the tyro. The second part of the book, which treats of the methods to be employed in making a traverse survey, seem particularly excellent. The process of taking azimuths with the compass, the measurement of distances, the recording of observations in a notebook, the distribution of errors, levelling, etc., are all described with an exactness and detail most useful to the amateur. The third

part, dealing with geodetic measurements, including astronomical observations, is also well written, but is perhaps a little beyond the range of the majority of the officers Captain de Larminat would induce to do useful work.

The Principal Navigations, Voyages, etc., of the English Nation. By Richard Hakluyt. Extra Series, Vol. xii. Glasgow: James MacLehose and Sons, Publishers to the University, 1905.

The twelfth and last volume of the new issue of Hakluyt's *Principal Navigations, etc.*, is taken up for the most part with an index to the eleven preceding volumes; but it also contains an excellent essay or appreciation of Hakluyt from the pen of Professor Walter Raleigh, of Glasgow University. The first section of the essay is historical, and sketches with a rapid, graphic, and judicious pen the story of "the Quest of the East," an incident or result of which was the discovery, conquest, and colonisation of the Western continent. To the readers of Hakluyt this part of Professor Raleigh's essay will be heartily welcome, as it condenses into a few pages the many narratives and histories which have engrossed, and it may be distracted, their attention in the previous volumes. The second section of the essay sets forth the little that is known of the public and private life of Hakluyt himself. A friend of Hawkins, Raleigh, Jenkinson, Burleigh, Sidney, Mercator, Ortelius, and others, "it is vain to look for traces of him among the works and memorials of the brilliant company that knew him in life. He is the silent man, seated in the dark corner, who is content to listen and remember, and whose questions, interpolated from time to time, divert attention from himself, and direct it to the moving tales that come in answer to them. . . . Among his friends and fellows, the Preacher moves like a shadow, giving his heart to search out concerning all things that are done under heaven, exercised with sore travail, and writing words of truth. The English nation may well be proud of him, and glad that, while its great destinies were still in the making, there lived a man quick enough to discern the significance of the deeds done around him, and steady enough, in purpose and perseverance, to encounter and overcome the difficulties of giving them an enduring chronicle." Born in London about 1553, educated at Westminster and Christ Church, Oxford, proficient in Greek, Latin, Italian, and French, Hakluyt determined to devote himself to geography and the exposition of exploration. Having taken orders, he became chaplain to the embassy in Paris, prebendary of Bristol, rector of Wetheringsett, archdeacon of Westminster, chaplain of the Savoy, and ultimately rector of Gedney in Lincolnshire. He died in 1616. His extraordinary industry, truthfulness, and simplicity found due recognition even among his contemporaries. We do not need to remind our readers that statesmanship and sagacity, sympathy and shrewdness, as well as kindliness and piety, are conspicuous throughout his works. In several respects he was far in advance of his age. "Throughout his life," says Professor Raleigh, "Hakluyt continued to urge on the government and public the importance of sound nautical education. His scheme, though nothing came of it, was a modest one. A lectureship should be established 'in London or about Ratcliffe in some convenient place,' and he tells how Sir Francis Drake offered twenty pounds a year to this end; but forty pounds a year was found needful to secure a fit man, and, no other donor presenting himself, the scheme fell through. The Spaniards, says Hakluyt, maintain at the Contractation House, or Exchange, in Seville, a learned Reader in the art of Navigation; and no one is given charge of ships for the Indies until he has attended the instructions of the Reader, and has satisfied a Board of Examiners who are joined with the Reader to test theoretical and practical knowledge. What Hakluyt desires, in short, is a Nautical University or Faculty, where men may be trained and graduated in all the sciences and crafts that are necessary to furnish forth the

complete navigator, and to make him an efficient servant of his country. He returns to the subject in his later dedications, pressing it on the attention of the Lord High Admiral and of Sir Robert Cecil. His was a voice crying in the wilderness; and to this day the naval and military professors have no dealings with university education. The man who should bring these into touch, who should enlist soldiers and sailors for the furtherance of knowledge, and give to the army and navy and merchant service officers wide-awake to the scientific opportunities of their calling, would be a benefactor to his country and a worthy disciple of Hakluyt. One at least of Hakluyt's ideas has had a very recent fulfilment. In his dedication of the third volume of his *Voyages* (1600) to Sir Robert Cecil, he speaks of a short treatise, which he had lying by him, touching *The curing of hot diseases incident to travellers in long and Southern voyages*, by one George Watson. He intended to include it in his book, but desisted, because it was very defective, and a certain Doctor Gilbert promised that the whole College of Physicians should confer, and produce something authoritative on the diseases of hot and cold regions. So the founders of recent Schools of Tropical Medicine are also disciples of Hakluyt."

The third section of the essay is a thoughtful and masterly appreciation of the influence Hakluyt's works had on the poetry and imagination of his age, as evidenced by the writings of such famous poets as Marlowe, Spenser, Shakespeare, and others. "Over against the plays of Shakespeare and his fellows," says Professor Raleigh, "must be set the voyages of Hakluyt; he who would understand the Elizabethan age, and what it meant for England, must know them both. . . . That marvellous summer of the imagination, the Elizabethan age, with all its wealth of flowers and fruit, was the gift to England of the sun that bronzed the faces of the voyagers and of the winds that carried them to the four quarters of the world. . . . The dramatists and poets were the children and inheritors of the voyagers. Before the first acre of land had been effectively added to the dominion of England, the poets had foretold the British Empire. The expansion of England was, in the main, the work of the eighteenth century; but the soldiers and statesmen who planted the Empire in India and Canada and the American Colonies were the successors and pupils of Hakluyt's heroes; it was theirs to build the fabric that had been designed, and to fulfil the prophecies that had been uttered in the great age of imagination. The chief influence of the *Voyages* on the English imagination is not to be looked for in special tributes or even in exalted prophecies like these. The new ferment wrought in a deep and hidden fashion on the temper and habits of the mind. All preconceived notions and beliefs concerning cosmography, history, politics, and society were made ridiculous by the new discoveries. The world had been opened up by the fanatical self-confidence of visionaries, and had proved to be wider than their wildest fancies. New kingdoms were to be had for the taking. Powers and virtues unknown to the peoples of the Old World had perhaps been preserved through the ages in remote and fortunate islands. All things became possible; credulity was wiser than experience; and the wonders reported were reckoned merely the first-fruits of greater things to come. The society of the Old World meanwhile was rent in twain by the schism in the Christian Church. Great monarchies were tottering to their fall. The signs and portents of the times pointed to the beginning of a new age, when the riches and power of the world should be the prize of bold adventurers, and courage the only passport to success."

We congratulate Messrs. MacLehose on the successful completion of the publication of so notable a work, and we cordially recommend Professor Raleigh's masterly essay to the perusal of our readers.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

Siberia : A Record of Travel, Climbing, and Exploration. By SAMUEL TURNER, F.R.G.S., with an Introduction by Baron HEYKING. Illustrated with Photographs by the Author. Pp. xxiv + 420. Demy 8vo. *Price* 21*s. net.* London : T. Fisher Unwin, 1905.

The Far East. By ARCHIBALD LITTLE. ("The Regions of the World" Series.) Large 8vo. Pp. viii + 334. *Price* 7*s.* 6*d. net.* Oxford : Clarendon Press, 1905.

Australasia. By G. L. GLOVER, B.A. ("Round the World" Series of Geographical Handbooks.) Pp. 78. *Price* 6*d.* London : T. C. and E. C. Jack, 1905.

Das Europäische Russland. Von A. HETTNER. 8vo. Pp. viii + 221. *Prix* 4*m.* Leipzig : B. G. Teubner, 1905.

Geografia de la Provincia de Córdoba. Par MANUEL E. RIA y LUIS ACHAVAL. 2 vols. and Atlas. Pp. Vol. I. xxx + 569 ; Vol. II. vi + 609. Atlas : 10 Maps, 62 Illustrations. Buenos Ayres, 1905.

The Junior Geography. By A. J. HERBERTSON, M.A., Ph.D. ("The Oxford Geographies.") Cr. 8vo. Pp. 288, with 166 Maps and Diagrams. *Price* 2*s.* Oxford : Clarendon Press, 1905.

In Search of El Dorado : A Wanderer's Experience. By ALEXANDER MACDONALD, F.R.G.S. Demy 8vo. Pp. xviii + 291. *Price* 10*s.* 6*d. net.* London : T. Fisher Unwin, 1905.

Also the following Reports, Pamphlets, etc. :—

Proceedings of the Royal Colonial Institute. Vol. XXXVI., 1904-1905. London, 1905.

British Rainfall, 1904. Forty-fourth Annual Volume. Compiled by HUGH ROBERT MILL, D.Sc., LL.D., F.R.S.E. London : Edward Stanford, 1905.

Sinopsis Estadistica i Jeografica de la Republica de Chile en 1903. Segunda Parte. Santiago, 1905.

Report of the Progress of the Ordnance Survey to the 31*st March* 1905. London, 1905.

Memoirs of the Geological Survey of Victoria, No. 3. Victoria, 1905.

Twenty-third Annual Report of the Fishery Board for Scotland for the Year 1904. Part III., Scientific Investigations. Glasgow, 1905.

Cyprus Blue-Book, 1904-5. Nicosia, 1905.

Geographical Index to Books, Periodicals, etc. Compiled in the Intelligence Division, War Office. London, 1905.

Panama Foreign Commercial Guides. Edited by EDWARD JAMES CATTELL. Part I. Philadelphia : Philadelphia Commercial Museum, 1905.

Annual Report of the Secretary for Mines and Water Supply for Victoria for the Year 1904. Melbourne, 1905.

Summary Report of the Geological Survey Department of Canada for the Year 1904. Ottawa, 1905.

The Statistical Year Book of Canada for 1904. Ottawa, 1905.

The Swedish-Norwegian Union Crisis : A History, with Documents. By K. NORDLUND. Pp. vi + 107. London : David Nutt, 1905.

Sweden for Peace : the Programme of Sweden in the Union Crisis. By NILS EDÉN. Pp. 41. London : David Nutt, 1905.

La France et le Siam. Par PARFAIT-CHARLES LEPESQUEUR. Pp. iv + 89. Paris : Société Académique Indo-Chinoise de France, 1897.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

SEISMOLOGICAL STUDIES.

By Professor C. G. Knott, D.Sc., F.R.S.E., etc.

In the *Scottish Geographical Magazine* for January 1899 I published an article on the New Seismology, which was to a large extent a review of Professor John Milne's book on Seismology. In that article the genesis and growth of new ideas in the study of earthquakes were briefly sketched; and some attempt was made to further our knowledge of the deep parts of our earth. The data then available as a basis of speculation have been greatly supplemented within the last six years; and distinct advance has been made along several lines. It was long the complaint of spectroscopists that for years after the spectroscope had become an instrument of accurate research, no really fine comet came our way to be catechised and analysed. The seismologist on the other hand is never left long without a reminder that the "solid ground" on which man builds is in frequent commotion. A new improved seismometer is hardly installed before a record is obtained of a fleeting oscillatory movement, the far-off couriers of a more or less violent quake. Milne's indefatigable energies, working through the Seismological Committee of the British Association, have resulted in the establishment of nearly forty seismological stations all over the earth's surface. At each of these the Milne Horizontal Pendulum is set up; and every half-year there flow in upon the central station at Shide in the Isle of Wight a converging flood of records. If we add to these the published records of the important seismological observatories in Italy,

Austria, Germany, Russia, and Japan, we have a steadily increasing mass of material ever ready for discussion.

In what follows I propose to indicate the advances made since January of 1899. The conclusions come to in the earlier article have been with some corrections in detail fully substantiated by more recent research. It is now established beyond the possibility of doubt that from an earthquake centre disturbances of various types spread out and travel with different speeds through the body of the earth and over its surface. Views differ somewhat as to the manner and lines of propagation; but as regards the preliminary tremors which form the first part of every record of an unfelt earthquake we must regard them—in the words of the earlier article (page 7)—"as due to the propagation along the path of shortest time of certain elastic vibrations set up by the initial movements at the earthquake focus." The phrase "unfelt earthquake" is a convenient expression, indicating that we are dealing with a mechanically recorded surface movement too small in amplitude and too long in period to be appreciable to our senses at the place where the record is taken, but too small only because we are not near enough to the origin where the disturbance was in all likelihood a violent earthquake.

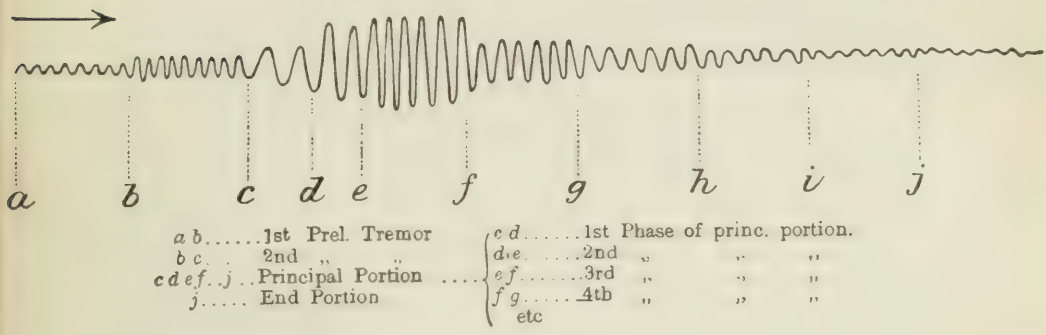
We shall first consider the broad characteristics of these records of unfelt earthquakes, following to some extent the classification of Professor Omori of Tokyo, to whom we owe very elaborate analyses of the records obtained with his improved form of horizontal pendulum. The early division of the record into Preliminary Tremors and Large Waves still holds, but further study has led to the recognition of sub-divisions of these. Oldham,[1] of the Geological Survey of India, was the first clearly to establish the existence in the complete record of two distinct phases in the Preliminary Tremors. These will be distinguished as P_1 and P_2. The entry of the second phase is usually marked by a sudden increase in the amplitude of the sinuous record, and in many cases by a longer period. There is frequently some difficulty in deciding as to the exact instant at which P_2 makes its appearance. Similarly there is in many cases a lack of precision in the time of commencement of the third phase, which marks the initial stages of the Large Waves, or Principal Portion as Omori prefers to call it. These points should be kept in mind when deductions are being made as to the speeds of propagation of the various kinds of motion.

But although there may be difficulty in always determining the initial stages of the Large Wave portion, there is no doubt as to its marked distinctiveness as a whole. It consists usually of a series of groups of undulations, each group attaining a maximum and being separated from the contiguous groups by intervening minima. After the last pronounced maximum the Principal Portion tails off into the End Portion, marking the gradual decay of the earthquake disturbance.

---

[1] See "On the Propagation of Earthquake Motion to Great Distances," *Phil. Trans.*, vol. cxciv., A. 1900.

From a careful study of the seismograms of unfelt earthquakes obtained in Tokyo, Omori divides the Principal Portion into a number of phases, each of which is characterised by the presence of a fairly constant period and a fairly uniform amplitude. I reproduce a sketch of his typical earthquake diagram and add his own description of some of the phases.



a b.....1st Prel. Tremor
b c.....2nd „ „
c d e f . . j ..Principal Portion ....
j..... End Portion

c d.....1st Phase of princ. portion.
d e.....2nd „ „ „
e f.....3rd „ „ „
f g.....4th „ „ „
etc

"The Principal Portion denotes the most active part of an earthquake, which follows the preliminary tremors, and consists of movements of larger amplitude. The earlier part of the principal portion is further subdivided into three successive stages as follows: (*a*) the first phase consisting of a few very slow undulations; (*b*) the second phase consisting of slow undulations whose period is somewhat shorter than in the first phase; (*c*) the third phase, consisting of vibrations of period much quicker than in the preceding two phases. The third phase is followed by others of smaller amplitude which may be termed the fourth, fifth, sixth . . . phases of the principal portion."[1]

It should be remarked, however, that both the diagram and the description are only broadly approximated to by any particular earthquake record. The motion indicated by any real record is complicated and difficult of analysis. It is an easy matter to reckon half a dozen periods in the wavering undulations which make up any one phase. But according to Omori's analysis there is a tendency for certain periods to be more characteristic of certain phases than of other phases. The following table, taken from Omori's paper of 1903, will indicate better than pages of letterpress the real meaning to be attached to the general statement given above. The results are average periods measured directly from the records of eleven large earthquakes originating far from Japan in Alaska, Asia Minor, Mexico, West Indies, Central Asia, and East Indies.

[1] See *Publications of the Earthquake Investigation Committee*, No. 13, 1903.

PERIODS OF VIBRATION IN SECONDS IN THE VARIOUS PHASES OF THE EARTHQUAKE RECORDS OF ELEVEN UNFELT EARTHQUAKES.

PRELIMINARY TREMORS.		PRINCIPAL PORTION OF LARGE WAVES.						END PORTION.
Phase 1	Phase 2	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	
1·5 (1)								
4·1 (6)	4·8 (2)	2·9 (1)						
7·8 (10)	8·2 (9)	8·7 (2)	9·9 (3)	10·1 (1)	11·7 (3)	9·5 (2)	8·1 (1)	9·9 (6)
13·9 (5)	15·0 (5)		14·1 (1)		14·9 (5)	14·3 (6)	14·5 (4)	14·3 (3)
18·0 (1)	19·6 (1)			20·4 (9)	19·9 (2)			19·8 (4)
	24·8 (3)			24·0 (3)		25·0 (1)	25·0 (1)	
	30·4 (2)		27·4 (5)					
		36·1 (3)	33·7 (8)	34·3 (1)				
40·3 (1)		44·6 (2)	42·7 (3)					
		54·0 (2)						
		66·0 (1)						

The figures in brackets after the number giving the period show the number of earthquakes in whose records that particular period was detected. If for the moment we regard six cases out of eleven as establishing a "character," we may say that the Preliminary Tremors are characterised by a period of about eight seconds, the second phase of the Large Waves by a period of thirty-four seconds, the third phase by a period of twenty seconds, the remaining phases by a period of fourteen to fifteen seconds, and the end portion by a period of ten seconds. If we take the so-called fourth, fifth, and sixth phases as belonging to the End Portion then the characteristic period is still about fifteen seconds.

Again, a broad glance at the general aspect of the table shows that the shortest periods are met with in the first preliminary tremors, that there is a tendency for somewhat longer periods in the second preliminary tremors, that the longest periods are encountered in the initial phase of the Large Waves, and that the end portion is characterised by periods intermediate between the shortest and longest.

Similar broad features are given by the analyses of other groups of earthquake records, with, however, considerable variations in detail. Thus, out of a group of eighty-four records of unfelt earthquakes, the periods which were met with in more than twenty of these were as follows :—

4·6 sec.	26 times	in First Preliminary Tremors.
8·7 „	28 „	in „ „ „
9·3 „	32 „	in third phase of Principal Portion.
9·6 „	32 „	in End Portion.
13·6 „	22 „	in third phase of Principal Portion.

From this analysis of one of Omori's tables we may conclude that there is a comparative constancy of period characterising the first preliminary tremors, the third phase of the large waves, and the end portion; but that there is not the same constancy of period in the other phases. As a matter of fact Omori's third phase of the Principal

Portion corresponds with what Milne has been accustomed to call the maximum movement. The time of its occurrence can usually be determined with an accuracy second only to the accuracy with which the first minute movements of the Preliminary Tremors can be timed.

Omori has also discussed in detail the comparative amplitudes of the motions in the various phases. We should expect that on the average the larger amplitudes should be associated with the longer period. This, broadly speaking, is what is established by Omori's analysis. It is only in the case of elastic vibrations in which the displacement is proportional to the restoring force, and in which there is no excessive damping of vibration,—it is only in such cases that the period is independent of the amplitude. Earthquake vibrations are elastic only to a first approximation; and reasoning from analogy we should expect the period on the whole to lengthen with increase of amplitude. It is interesting, however, to give the average results of Omori's comparisons. Representing the maximum in the first preliminary tremors by unity, the maxima in the second preliminary tremors and in the three successive phases of the principal portion are roughly as the numbers 4, 6·5, 10, and 11.

These results apply to the records obtained with Omori's horizontal pendulum; but it is well to bear in mind that different instruments may give different results. It is certain indeed that the phenomenon known as resonance will occasionally come into play so as to make the record deviate in details from the movement of the ground which it is supposed to reproduce. Each horizontal pendulum consists of a weighted boom, which is set up with so small a stability as to have a natural period of from twelve to sixty seconds. From the results given above it will be seen that the most frequently occurring periods lie between the limits of four and, say, twenty seconds. To prevent frequent resonance effects, horizontal pendulums should have periods distinctly longer than half a minute; and no doubt the longer the better. In this respect the more massive horizontal pendulums, such as are installed in Italy, in Tokyo, and in Shide, are better than the lighter forms which have been supplied by the British Association Committee to its various stations. In many cases the records do unmistakably show the presence of resonance. A comparatively small earth movement may, if of the appropriate period, set up a greater motion in the boom of the seismometer than a large movement of different period. It is only to a first approximation that the weight on the seismometer boom acts as a steady point. The earth movement must in the end start a movement in the boom itself; and when this earth movement is fairly periodic with a period approximating to the swing period of the horizontal pendulum, the motion ultimately generated will be considerable. When a sinuosity begins small and works up gradually but steadily to greater and greater amplitudes in the successive waves, we may, in many cases, regard this as due to resonance. To what extent the horizontal pendulum faithfully records the movements of the ground is a problem still awaiting solution. The dynamical theory of the instrument is indeed far from being thoroughly understood. It is sensitive both to horizontal movements of the ground and to the tiltings which accompany long surface waves.

The evidence at present seems to point to the main effect in most seismograms as being due to horizontal movements. But records of unfelt earthquakes have been obtained with Darwin's bifilar suspension, which is sensitive only to tiltings. An important example of this kind was the record obtained in Edinburgh on the occasion of the great Assam earthquake of 1897.

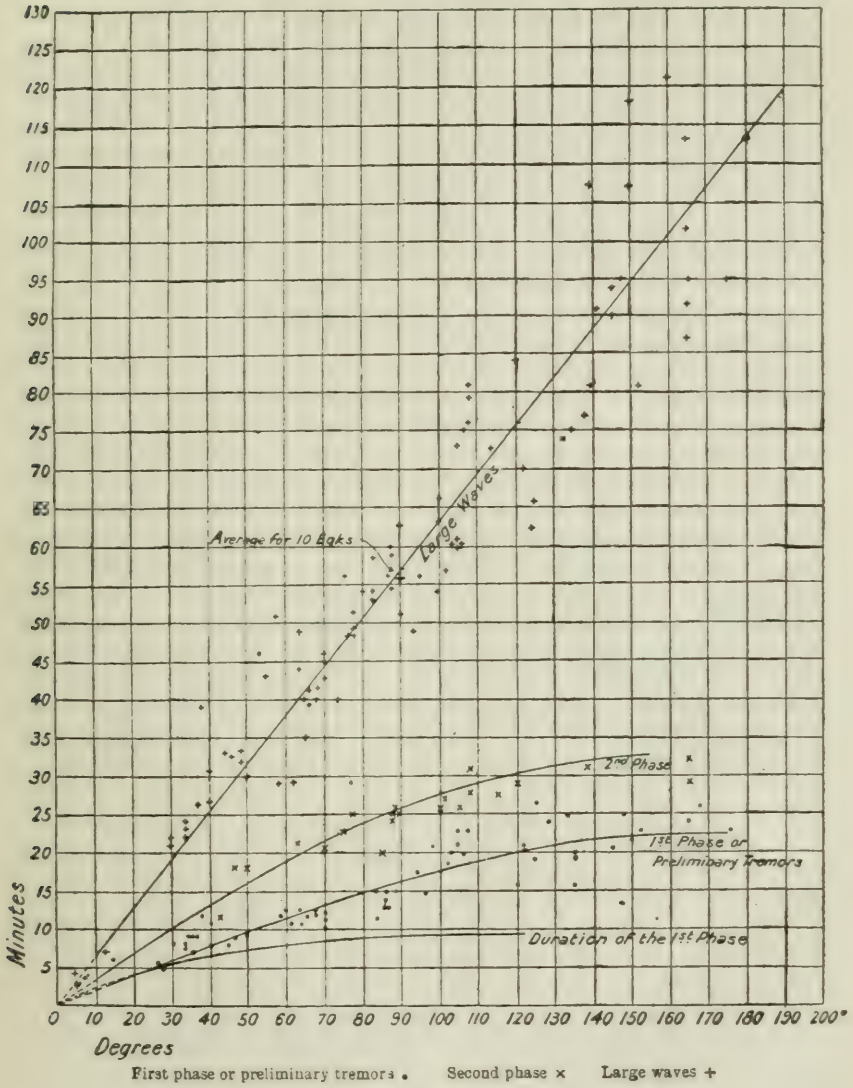
Passing now from the discussion of the individual records at any one place, let us compare the records at different stations of one and the same earthquake. This brings us to the problem of the propagation of disturbances through the earth or over its surface.

The first broad fact we are able to establish is that the duration of each of the recognised phases in the record increases as the distance from the origin increases, so that the whole record lasts a longer time at the more distant station. Very close to the origin it is not always possible to distinguish the two phases of the preliminary tremors; and the large motion follows on in less than a minute. At an earth's quadrant distance from the origin the preliminary tremors last some thirty minutes before they are overwhelmed in the much greater motion of the Large Waves. The conclusion is obvious. We are dealing with a complex set of disturbances which originate at the seismic focus and pass outwards in all directions with very different speeds of propagation. To determine these various speeds we must be able to identify the corresponding phases of the seismograms obtained at different stations. But this identification is not such a simple matter as might at first be supposed. Each instrument has, so to speak, its personal equation; and even were the instruments at the various stations exactly the same in all their dynamical properties there would still be a cause of difference in the character of the ground and the nature of the path along which the disturbance travelled. Several years before the first undoubted observation of an unfelt distant earthquake I pointed out[1] that the heterogeneity of the crust of the earth would, in virtue of reflections and refractions at separating boundary lines, greatly alter the form of the disturbance being propagated through it. What was then true for felt earthquake motions will undoubtedly hold for the comparatively small vibrations which record themselves mechanically at far distant stations. There is no doubt, however, that the broad distinction between the preliminary tremors and the Large Waves holds for all fairly complete seismograms; and there is of course no difficulty in timing the beginning of the first phase of the preliminary tremors. Whatever error creeps in here must be due to instrumental sluggishness in responding to the earth movement. It is quite otherwise with the other phases. Their entry is, in many cases, difficult to time. Milne is in the habit of taking the maximum displacement in the Large Wave phase as the part most easily identified in different seismograms; and this corresponds with what Omori calls the third phase in the Principal Portion.

There is a certain rough arithmetical relationship among the times of duration of the successive phases, so that once the speeds of

[1] *Trans. Seism. Soc. of Japan*, vol. xii. 1888; reprinted with additions in *The Philosophical Magazine*, vol. xlviii. 1899.

transit of the first preliminary tremors and of the maximum Large Waves are determined, the speeds of transit of the intermediate phases


Minutes
Degrees
Average for 10 Eqks
Large Waves
2nd Phase
1st Phase or Preliminary Tremors
Duration of the 1st Phase
First phase or preliminary tremors • Second phase × Large waves +

will, of course, be determinable with fair accuracy. My experience is that the direct determination of the speeds belonging to these intermediate phases is distinctly inferior in accuracy to the determinations of the speeds of the two most easily identified; and that simple interpolation is sufficiently accurate in the mean time.

The earlier results obtained from the data collated by Milne indicated that the P_1 Tremors and the Large Wave Maximum followed

different laws of propagation from the seismic focus to distant stations. Oldham's discussion of seven great earthquakes gave similar results. In the British Association Report for 1902, Milne gives time-curves showing how the P_1 and P_2 tremors and the Large Wave maximum travel through or over the earth. The diagram is here reproduced (p. 576). The arcual distances of the stations from the seismic focus in each earthquake for which records were obtained are measured horizontally, and the corresponding times of the respective motions reckoned from the epoch are measured vertically. The points so obtained cluster along and around three lines. In the case of the Large Wave maxima the line is practically straight, showing that the large waves in all probability pass superficially over the earth, with an average speed of 95° per hour, or 0·028 radians per minute.[1] Such waves take a little less than two hours to run right round the earth.

The lines representing the average time-curves for the first and second phases of the preliminary tremors are quite distinctly not straight. The curves seem to tend to a maximum as they approach the arcual distance of 180°. My view has always been that these waves pass through the earth by brachistochronic paths, the form of which depends on the law of variation of the elastic properties with the depth below the surface. The form of the time-curve for P_1 at once suggested that the path was very approximately along the chord; and I showed in the Report referred to that the first preliminary tremor curve fitted the formula, time $\propto$ chord, at least to within the errors of observation. The relations are shown in the following table, which is an improved modification of the table given in the Report. The first column gives the arcual distances, and the second and third the average times of start of the first and second preliminary tremors reckoned from the epoch of the earthquake. These are all *averages* picked off Milne's curves. The fourth column contains the chords corresponding to the arcs; and the fifth and sixth, the ratios of the chords to the times for P_1 and P_2 respectively.

TRANSIT SPEEDS OF P_1 AND P_2 ESTIMATED IN TERMS OF THE CHORDS.

ARC.	TIMES.		CHORD.	SPEED IN EARTH-RADIUS PER MINUTE.	
	P_1	P_2		P_1	P_2
20°	4	6·9	0·344	0·0865	0·0503
40°	8	13·3	0·680	0·0855	0·0514
60°	11·4	19·0	1·00	0·0877	0·0526
80°	15	23·9	1·29	0·0860	0·0540
100°	17·7	27·8	1·53	0·0864	0·0551
120°	20	30·3	1·73	0·0865	0·0571
140°	21·7	32·1	1·88	0·0866	0·0586
160°	22·2	32·9	1·93	0·0869	0·0587

[1] There is great convenience in expressing the arcual speeds in radians per minute, and the chordal speed in earth-radius per minute. The unit length is the same in both, and we pass to miles per second by multiplying by 66, and to kilometres per second by multiplying by 106.

The remarkable constancy of the ratios for P_1 shows that we are dealing with the true speed, and indicates that the first preliminary tremors are propagated practically along the chord between the seismic focus and the station of observation. The ratios for P_2 do not show the same constancy. Here, in short, we are dealing with waves whose brachistochronic paths deviate considerably from the chords. The ratio increases at a fairly rapid rate as the distance increases. Nor can we regard them as surface waves. All we can at present infer is that the elastic constant on which the speed of the P_2 waves depends increases with the depth at a somewhat greater rate than does the density.

The evidence so far goes to show that the Large Waves maxima are propagated along the surface with a speed of about 0·028 radians per minute = 3 kilometres per second = 1·85 miles per second; and that the first Preliminary Tremors are propagated through the body of the earth with a speed of 0·0865 earth-radius per minute = 9·17 kilometres per second = 5·7 miles per second. The average speed of the second Preliminary Tremors across a diameter comes out about 0·059 earth-radius per minute = 6·25 kilometres per second = 3·9 miles per second.

Some of the conclusions just indicated are not accepted by the Japanese seismologist. Omori considers that all the types of wave are transmitted arcually, not necessarily along the surface, but along appropriate arcual layers parallel to the surface. The general idea is that there is a speed peculiar to each layer, and that there is a particular layer of maximum velocity along which the preliminary tremors are transmitted. In No. 16 (1904) of the Publications of the (Japanese) Earthquake Investigation Committee, Imamura has brought together a large amount of material in support of this view. No fewer than eighty-five earthquakes are discussed; but in regard to the debated question of the transit speed of the preliminary tremors, the great majority of these are, on the author's own admission, of absolutely no account. The origins of only fifteen of the eight hundred and fifty-three were definitely known; in all other cases the origins were estimated by comparisons of the seismograms at different stations. This method is sufficiently satisfactory for ordinary purposes; but it can hardly be accepted as a trustworthy basis for a sound scientific argument as to the speeds of propagation of the various phases of the earthquake motion. But a much more serious objection to Imamura's method is that in all but three cases he has estimated the epoch of the earthquake at the origin on the assumption of the arcual propagation of the preliminary tremors. Indeed, it cannot be too strongly urged that those earthquakes only whose epochs are known definitely to within a minute are of any value in an investigation of this kind. It is not always possible to get this information, especially if the origin is under the ocean. Even in cases when the origin is under the land there is frequently difficulty in timing the exact occurrence of the quake, chiefly because of the lack of accuracy in the measurement of local time. For of course it is obvious that all times must be expressed in terms of one standard, say, Greenwich Mean Time. But unless there is a properly organised observatory near the earthquake origin there is no guarantee as to the meaning of local time, which may easily be uncertain to five or ten minutes.

Imamura's method is as follows:—From the returns of the British Association stations provided with the Milne horizontal pendulum, the times of arrival of the disturbance of a particular earthquake are tabulated alongside the arcual distances from the origin of the corresponding stations, the origin being in many cases estimated. The times are then plotted against the arcual distances. The majority of points so obtained are found to lie fairly near a straight line which is drawn by eye through them. Any points distinctly off the straight line are regarded as referring not to the first phase but to some later phase, and are consequently neglected. From the time graph so obtained the arcual speed of propagation of the first phase can be easily calculated, and also the epoch of the earthquake. The epoch being thus found by a calculation based on the assumption of what the author aims at proving, the record of the same quake on Omori's horizontal pendulum at Hongo, Tokyo, is studied, and the assumed arcual speeds of the various phases thereby determined.

Now, the great majority of records are obtained at stations whose arcual distances from the earthquake origin lie between 40° and 100°. But if we construct a curve whose ordinates are arcual lengths taken between these limits and the corresponding chords we shall get a set of points which are as approximately collinear as points obtained from earthquake observations. Not until we get to stations from 120° to 180° from the origin can we hope to find any marked divergence between an assumed arcual and an assumed chordal propagation. There are, unfortunately, among the earthquakes studied by Imamura not more than about a dozen giving records for stations more distant than 120°, and several of these cannot be called satisfactory. Moreover, if we limit our attention to the only scientifically acceptable cases in which the epoch is definitely known, Imamura's list of eighty-five earthquakes reduces to three, namely —the Mexico earthquake of January 20, 1900, the Manila earthquake of December 14, 1901, and the Guatemala earthquake of April 19, 1902.

In regard to the Manila earthquake, Imamura remarks that his graphic representation gives a transit velocity of 11·5 km. per second for the first 50°, but an average of 13·6 km. per second. He has no observations between distances 46° and 90°; but if we put in the observation at Christchurch (75°) we find that it fits in very well when a continuous curved line is drawn through all points up to an arcual distance of 110°. The few remaining observations at stations further distant are higher in the diagram than the continuation of this curved line; but this may easily be due to the first appearance of the tremors being delayed at the greater distance, an extremely probable thing to happen.

It is obvious indeed that, strictly speaking, we should not take *means* of observations, but should give weight to those which occur sooner than the average. This is a case in which because of loss of energy and sluggishness of instrumental response the tendency is all in favour of retardation of the first appearance of the tremors, so that at the more distant stations we are dealing with a somewhat later phase than that which is first recorded at the nearer stations.

The most complete of all the cases discussed by Imamura is the Guatemala earthquake of 1902. Oldham, in a recent paper published in the *Proceedings of the Royal Society* (1905), has criticised the methods and conclusions of the Japanese seismologist, and has brought together all the possible material available for a complete study of the transit velocities of the first and second tremors and of the large waves. He shows that Milne's original estimate of the epoch (2 h. 22 m. G.M.T.) is more accurate than that adopted by Imamura, namely, 2 h. 26 m. This difference of four minutes will affect considerably the estimated speed of propagation, and will quite destroy the linearity of the time graph of the first tremors regarded as a whole. Forty-six of the sixty-one individual records collected by Oldham are grouped together according to distance in seven average groups. Dividing the arcual distance of each average group from the origin by the corresponding time reckoned from the epoch, Oldham finds that this ratio increases with the arcual distance.

I have discussed the data in a different way. Assuming a linear relation between the time and the distance, arcual or chordal as the case may be, I have worked out, by the method of least squares, the co-efficient of each term. Calling the arc θ, and the chord x, and representing by t_1 and t_2, the times respectively of the first tremors and the large wave maximum reckoned from the epoch of the earthquake, I find the relations to be as follows:—

First Tremor.	Large Waves' Maximum.
$\theta = -0{\cdot}319 + 0{\cdot}134t_1$.	$\theta = 0{\cdot}0066 + 0{\cdot}0302t_2$.
$x = -0{\cdot}097 + 0{\cdot}0976t_1$.	$x = 0{\cdot}3062 + 0{\cdot}0185t_2$.

The first term in each expression shows to what degree of approximation the times and distances can be regarded as strictly proportional. The smaller this term the better the approximation. Evidently the chord formula is better for the first tremors, and the arc formula for the large waves. There is no question as to the mode of propagation of the large waves; the chord or x formula is meaningless, demanding an epoch about seventeen minutes earlier than the true epoch. But it is the chord formula which best suits the first tremors, the arc or θ formula demanding an epoch 2·4 minutes later than the true epoch.

The co-efficients of t in each represents the speed of propagation in radians or in earth-radius per second. Hence the first tremors are propagated with an average chordal speed of 6·4 mls. per second, or 10·3 km. per second; while the large wave maximum is propagated with an arcual speed of 2 mls. per second, or 3·2 km. per second.

I have tested several other cases by the same method and have obtained very similar results. I need not here go into details. The general conclusion is, that the assumption of a linear relation between chord and time for the first preliminary tremors gives invariably an earlier epoch than the assumption of a linear relation between arc and time; and that this earlier epoch is in close agreement with the real epoch when that is known independently, and with the estimated epoch when a linear

relation is assumed between the arc and the time in the case of the Large Waves maximum. It is not here maintained that the preliminary tremors pass accurately along the chords; but the evidence certainly goes to show that the chordal transmission is a better approximation than arcual transmission at different depths. It must be a brachistochronic transmission in all cases; and we have not only the first tremors to consider, but also the second phase of the preliminary tremors. If we follow the lines of the Japanese seismologists, we must assume a distinct layer along which the second tremors are transmitted parallel to the first, but at a slower rate. In no other way can we explain what all observers recognise—the abruptness of the advent of the second phase of tremors.

Looking at the problem generally, we are evidently dealing with the superposition of two or three distinct types of waves producing at any one station a succession of wave groups of very complex form and constitution. Omori's remarkable investigations into the periods of oscillation present in the Tokyo records of unfelt earthquakes have led him to a conclusion of no little interest. He finds that one of the characteristic periods of the first preliminary tremors, namely 4·8 seconds, is the period most prevalent in the pulsations of the soil at Tokyo. These pulsations are not due to earthquakes. They come on at intervals and remain for shorter or longer durations. Milne very early showed that they often appeared when certain winds were blowing strongly on the hills far to the west of Tokyo. Apparently this period of 4·8 seconds is peculiar to the plain in which Tokyo lies; and the evidence advanced by Omori is to the effect that this period belongs to the district in which the station lies and not to the original earthquake motion. If this be so, we have a kind of analogy to the seiche phenomenon in lakes. The seiches are started no doubt by external influences, but their period is characteristic of the lake itself. Moreover, just as there is an endless series of possible periods peculiar to each lake, so there will be for any limited continuous part of the earth's crust a series of elastic or quasi-elastic vibrations each with its own period. The genesis of such vibrations by the invasion of a complex disturbance due to a distant earthquake is not only dynamically possible but dynamically certain, especially since this disturbance has been drawn out in time because of the different speeds of transit of its different parts.

The marked advent of the second phase of the preliminary tremors almost demonstrates the existence in the mass of the earth of two sets of elastic vibrations propagated from the seismic focus. We may in a general way compare these to what are known as the compressional and distortional waves in a homogeneous elastic solid, or (as they are also called from the kinematical standpoint) longitudinal and transverse waves. But as I showed in my 1888 paper on elastic vibrations and seismic phenomena, either of these types of motion will give rise to the other type at boundaries separating materials of different elastic properties. In the end then it will be impossible to recognise by the kinematical character of any particular part what type of disturbance gave rise to it. The probability is, however, that each kind of disturbance

travels through a fairly long stretch of comparatively homogeneous material situated at considerable depths below the surface. The compressional part will here outrace the distortional part; and, though the motion will become again mixed up as it emerges through the heterogeneous crust, still this part which constitutes the first preliminary tremors may reasonably enough be regarded as corresponding to the compressional wave. In like manner we may regard the advent of the second phase as timing the arrival of what throughout the greater part of their course have been distortional waves travelling at a somewhat slower pace than the (mainly) compressional disturbance.

The Large Waves are evidently surface waves propagated round the earth with a fairly constant speed; but everywhere their effect will be mingled with the effect due to the outcrop of mass waves. In all probability also these large waves at any given place will give rise to secondary disturbances of the compressional and distortional types, which, running ahead of their parents through the underlying layers, will emerge further on and help to increase the effect of the preliminary tremors which have had their origin elsewhere. Thus the record becomes continuous from the first shiver of the preliminary tremors to the most active part of the motion; but the continuity is marked by interference of group-forming sets of vibrations, attains successive maxima with intermediate minima, and finally tails off into an end portion of decaying groups of oscillations. It is quite in accordance with recognised dynamical principles that the earlier portion of the whole disturbance should be characterised by shorter periods than the later portions; and we may find a reason for the long periods of the middle portion by an appeal to the principle of wave groups passing through a region with its own vibration periods. The problem is dynamically a difficult one; and we are still far from thoroughly understanding the genesis and maintenance of wave motion even in the case of the more familiar waves on ocean and lake.

Beginning at the earthquake origin the Large Waves will spread out as circular waves through the earth's crust, and will converge again at the antipodes of the seismic focus. From there they will spread backwards towards the origin again. Hence for a sufficiently strong earthquake we should expect to find at a station distant (say) 90° from the origin a second set of large waves about two hours later than the first set. More generally, at a station distant A° from the origin the Large Wave maximum will occur at A 95 hours after the epoch, and will be followed by the corresponding return wave at an interval of $(360 - A)$ 95 hours. Any seismogram which extends over three hours at ordinarily distant stations should show some sign of this repetition of the Large Wave maximum. In what is known as the end portion of the more extended seismograms maxima may easily be picked out at the position indicated by theory; but it seems to me that the identification of a particular maximum with the Large Waves is often a case of finding a thing where you wish it to be. The British records of the late Indian earthquake of April 4, 1905, do, however, unmistakably show a marked

maximum towards the end. Measuring the interval between the Large Wave maximum and the middle of this secondary swelling out of the record towards the end, I find as follows for various British stations furnished with the Milne Horizontal Pendulum :—

Station.		Interval between LW max. and its supposed repetition.
Shide,	NS motion	2·3 hours
,,	EW ,,	2·0 ,,
Bidston	EW ,,	2·5 ,,
Paisley	EW ,,	2·4 ,,
Edinburgh,	EW ,,	2·5 ,,

Now the arcual distance of Lahore from Great Britain is about 60°. Hence the repetition should succeed the Large Wave maximum by about $300/95 = 3{\cdot}16$ hours. If we take 100° per hour (the speed indicated in some cases) the result is not very different. We can hardly regard the comparison as satisfactory; but it is well to notice that the interval as indicated by the two Shide instruments, which give the motions in perpendicular directions, differ by as much as a third of an hour. It is possible, also, that the speed of propagation of the Large Waves for this particular earthquake may have been somewhat higher than the average. Evidence is not lacking that the speeds of propagation do depend in some measure upon the original intensity and the position of the seismic focus.

THE BASIN OF LAKE TITICACA.[1]

By A. F. Bandelier.

In the heart of the western part of South America, between the 16th and 17th degrees of south latitude and the 68th and 70th of longitude west of Greenwich, lies the extensive water-sheet of Lake Titicaca, at an altitude of 12,466 feet above the level of the Pacific. By air-line it is about 300 miles from the western, and at least 2000 miles from the Atlantic, shore. Peru claims two-thirds of its surface, and Bolivia the south-eastern third; but, as yet, the boundary line is indefinite.

Approach to the lake from the west and south-west is quite abrupt as far as Arequipa, where the peaks of the slumbering volcano Misti (19,250 feet), and its northern companion Chachani (20,300), rise like towering monuments. They are, for some distance, the most southerly pillars (Pichu-Pichu, about 18,000 feet high, forming but an elongated crest) of the Peruvian coast Cordillera. North of Arequipa a number of summits, part of which are mentioned in dim Indian tradition

[1] See the *Bulletin of the American Geographical Society*, No. 8, 1905; and cf. also this *Magazine*, p. 249.

as formerly active volcanoes, rise to still greater elevations, like the Koro-Puna, the altitude of which is said to exceed 23,000 feet, which would make it the highest mountain on the American continent, so far as known. Crossing, between Misti and Chachani, a wild labyrinth of volcanic débris, a high tableland is reached, on which the railroad has to climb to 14,660 feet at the station of Cruces, near Vincocaya. This plateau is cold, bleak, and correspondingly dismal. The vicuña still roams over it in small flocks, and human abodes are few and far between. From near the culminating point the column of smoke issuing from the crater of the volcano of Ubinas rises on the southern horizon, and the dark mass of Omate, the top of which was blown to atoms during the terrible eruption of 1600 (like that of Coseguina in Central America, and Mont Pelé in Martinique), rises up in the neighbourhood of Ubinas with its four prongs, indicating the ruins of its crater.

Descent to Lake Titicaca is gradual. The beautiful lagoons of Saracocha and Parinacocha, picturesque, but with very bleak shores, nestle at the base of the snow-clad range of Lampa; then a deep furrow is entered that has some arborescent vegetation, and a number of Indian settlements, haciendas, and the mining establishment of Maravillas. This furrow leads to the marshy shores of the Rio Ramis at Juliaca, a village the site of which was occupied by an Indian settlement at the time of the Conquest. The region now reached belonged to what in primitive times was termed the Collao, and was held by Indians of Aymará stock. Since then the Quichua have, under Spanish rule, slowly encroached, and they occupy the territory as far as the northern half of the town of Puno.

Lake Titicaca is reached by the railroad near the former principal settlements of the Aymará, Paucar-Colla, and Hatun-Colla, now reduced to insignificant hamlets. Nor were they ever very populous. The idea of a former large population belongs to romance. Statistics prove that the present Indian population of these regions has not diminished; and the evidence adduced in favour of a supposed dense primitive settlement of the land, based upon the countless artificial terraces that streak nearly every slope, is by no means conclusive. The extent of levels is small, and, where they lie along streams and are therefore susceptible of irrigation, they are also exposed to overflow; and a large portion of them is occupied by marshes, which, along the Ramis, are often alkaline. For this reason the Indian had to cultivate the slopes in preference, converting them into narrow terraced garden-beds. This system obtains to-day, and many of the andenes (as the Quichuas call them) are modern. Furthermore, the Indian had no fertilisers; neither will he use manure to-day, but prefers to let the soil restore its productiveness through rest. That rest lasts, according to local conditions, from one to ten and more years, so that only a limited extent of the numberless artificial terraces was tilled at the same time, and these are, consequently, no criterion as to the former numbers of the people.

Already from the heights overlooking the track along the lake-shore a glimpse is obtained of the magnificent chain of snowy peaks extending along the eastern side of Lake Titicaca from south-eastern Peru into

central Bolivia, and known, in its Bolivian portion, as the Andes of Bolivia, or Cordillera Real. Along the base of these magnificent Alps of South America, conspicuous through the strong individualisation of each mountain and the abundance of characteristic glaciers, Lake Titicaca extends from north-west to south-east like a trough, abrupt and very deep along the north-eastern, and gently sloping from the western shore, as far as the main body of the lake extends.

Puno existed, as an Indian village, certainly in 1548; hence, it is likely that the site was occupied already before the Conquest. It now has about 5500 inhabitants, the majority of whom are mixed with Indian blood. The Spanish settlement was officially recognised as such in 1668 or 1669. It is the Peruvian port for the navigation of the lake to the Bolivian shores.

Lake Titicaca fills a trough about 120 miles long, at the south-western base of the Bolivian Andes. It consists of the main lake, 41 miles wide at its greatest expansion, and several large bays, like the lagoon of Chucuito, on which Puno is located, the most northern bay in front of Taraco and Vilque on Peruvian territory, and the extreme south-eastern lagoons of Chililaya and Uinamarca. While in the main lake accurate determinations of depths on the west give no figures much in excess of 609 feet, on the eastern or Bolivian side we find 828 and 841 feet. Near the little island of Koa a depth of 1312 feet is recorded. About the island of Titicaca, the promontory of Copacabana, and as far as the mouth of the straits of Tiquina, the lake is very deep; but in these straits, by which the main lake communicates with its south-eastern annexes, depths diminish almost suddenly to 230 feet. It looks, therefore, as if Lake Titicaca had been imperceptibly falling during a period of unknown length. The lagoon of Umayo (near which stand the Inca buildings of Sillustani) was formerly connected, if tradition is right, with the lake; now the water has receded from the channels that established connection.

The only outflow of Lake Titicaca is the Desaguadero, a channel of sluggish waters draining into the lagoon of Poopó, in the south-west, which, in turn, has no visible outlet. There is traditional indication to the effect that the Desaguadero was opened (through some unknown process) at a very remote period, still within the scope of dim memory. It is also possible that, not many centuries previous to the Columbian Era, the lagoon of Uinamarca bathed a part of what are now the ruins of Tiaguanaco.

The water of Lake Titicaca is brackish, but not unwholesome. We had to drink it for several weeks almost exclusively, on the island of Koati, and felt no bad effects. It is always cold. At a depth of 99 feet Agassiz found its temperature to be 15° centigrade, at 450 feet 10·6°. Nobody has, as yet, been able to withstand its numbing effects longer than about a quarter of an hour.

There is, as indicated, a single outlet to the lake, the Desaguadero, and the feeders are few, on the surface. The Ramis and Suchez enter from the north, from the east the Rio de Achacache. None of these rivers is more than an ordinary stream, not large enough for navigation.

During winter the sky is mostly of an intense blue, the air chilling, while the sun's rays scorch and burn face and hands. Still, thunderstorms occur every month, and snowfalls are not uncommon. In summer a lowering sky often covers the mountain ranges, which are the only redeeming feature of the landscape; thunderstorms are of almost daily occurrence, thunderbolts very frequent, and waterspouts not rare. We saw two together, in the middle of the lake; and reliable informers state that as many as five have been observed at the same time. During tempestuous nights St. Elmo fires gleam on the steamers' masts. And, yet, rare is the evening when, for a few hours at least, the Bolivian Cordillera does not shine out, even if thin vapour rises before it from the deep gorges at its foot, and seldom is the whole chain, from the Carabaya range, in the north, to Illimani, in the extreme south, completely shrouded. In August, when winter is at its height and the skies cloudless, the Bolivian Andes sometimes display an alpine glow of unequalled splendour.

Our observations of temperature on Titicaca Island, carried on for three and a half months in succession, and later ones on the same island and on its neighbour, Koati, indicate a very equable climate. The mean for January 1895 was 54·9°; for February, 55·2°; in March, 54·8°. In winter of the same year temperatures were, of course, lower, but the extremes of temperature from January 1st to July 1st, 1895, were only 65° and 33°. I do not lose sight of the fact that such local observations, carried on for a short period only, have no value except for their time and the place where they were taken; but meteorological observations at La Paz extend over a period of many years, and establish the equableness of the climate beyond any doubt. That climate has, in fact, but two seasons—winter, which is cold and less moist; and summer, which is wet and equally cold. One is as disagreeable as the other, though not unhealthy.

To the coldness of the climate (first of all a consequence of the great altitude) the proximity of the snowy ranges contributes. In the west the few summits that rise above the snowline between Puno and Moquegua, the Kaualluni, and the Uilcaconga, are neither high nor striking in appearance. The lofty ranges between Cuzco and Juliaca, towering Kunnu-Rona (Santa Rosa), and bold Vilcata, that rises above the source of the Amazon river, at La Raya, are too distant. But the eastern range approaches the lake as near as twenty-five miles in its two culminating peaks of the Sorata group, the Hilampi, or Hanko-Kunnu, and the Hanko-Uma, rising respectively to 21,300 and 21,490 feet, according to latest determinations. The Sorata group terminates the "royal range" (*Cordillera real*) in the north. South of it that alpine chain of unsurpassed beauty in outline and in abundance of formidable glaciers, but without the softening feature of meadows and forests—grand, solemn, and chilling—extends to its southern pillar, Illimani, the altitude of which was determined by Sir Martin Conway, on his *first* (and thus far *only*) ascent, in September 1898, at 21,190 feet. Between Sorata and Illimani the strikingly individualised peaks exceed, as far as known, twenty thousand feet at only two or three places. The

Karka-Jake (erroneously called Huayna Potosi) reaches 20,300, and the Chachacomani 20,600 feet.

Glaciers abound on the Pacific slopes of the chain. The Atlantic declivity is very steep; hence it shows few of these truly alpine features. At present, and for a number of years past, the glaciers of the Bolivian Andes have been in slow retrocession. The deep clefts, meandering from the fronts of actual glaciers towards the upper Puna, or tableland, bear every mark of having been eroded by glacial action at a very remote period.

North of the Sorata group there is a break in the continuity of the snowy range. The Andes of Carabaya lie farther from the lake-basin than those of Bolivia, but are visible from the western shores and from Puno. Their relative altitudes are as yet but imperfectly known. Their most important and most northerly group, Ananea and Palomani, may yet prove higher than believed, for both summits rise out of enormous glaciers and snowfields. South of them the chain is made up of picturesque clusters of sharp peaks and cones; but the snow-line is not unbroken, as it is farther south. The eastern slope is, as everywhere else in that region, very steep.

This extensive barrier, separating Lake Titicaca from the wooded lowlands of the Amazonian basin, acts to intensify the chill in the climate of Titicaca. The Indian, who looks at nature only from the standpoint of the dangerous or the useful—who feels, above all, his own helplessness in presence of incomprehensible phenomena—sees in the stately peaks the abodes of spirits, and worships them as such. The taller the mountain, the more powerful the Achachila (literally, "grandfather") supposed to dwell in it. To the Indians of the main islands in the lake the principal *Nevados* appeal mostly as originators of angry blasts and damaging frost.

The region of the lake, as well as the mountains, has as yet been but partially investigated from a geological point of view. The crest of the Bolivian Andes and the upper slopes are Silurian, here and there traversed by upheavals of syenite, as, for instance, at the so-called Huayna Potosi. Lower down and as far as the middle of the tableland, or Puna, Devonian strata appear. On the west the Permian formation prevails. The basin proper is also crossed by streaks of carboniferous rocks, containing stone-coal of a fair quality, not seldom accompanied by trachytic (andesitic) dykes. The Puna south of the lake is said to be Devonian in the main. Explorations conducted by Professor A. Dereims, the French geologist, will at last furnish us with a true picture of the geology of the region.

The mineral resources of the surroundings of Lake Titicaca are not inconsiderable. Coal does not, as yet, play any rôle in production, which is the more regrettable in that its quality is good and the seams of easy access. Copper in its native state, as large chunks or blocks, but chiefly disseminated in minute particles through a Permian sandrock, in proportions varying from less than ten to seventy-five per cent., crops out at Corocoro, near the Desaguadero, in enormous veins tilted at an angle of about forty-five degrees. Tin is worked in the cordillera

not far south of La Paz; and it is also found at Carabuco, near the lake shore. Silver ores abound in the district of Sicasica, and gold is now washed on a large scale at the very doors of the city of La Paz. In the mineral wealth and in the industries therefrom resulting lies the future of the lake region; neither the vegetable nor the animal kingdom offers any inducements.

At an elevation of twelve thousand feet, vegetation, even under the tropics, is reduced to a minimum. Not many spots on the lake-shore are sheltered enough to permit the growth of trees and of low, bushy maize. The surroundings of the sanctuary of Copacabana offer a succession of favoured nooks, where—besides some trees imported by the Spaniards, like the eucalyptus—the wild olive-tree (*Buddleya coriacea*), the keñua (*Polylepsis racemosa*), and *Sambucus Peruviana*, grow in stunted specimens. This is also the case on the southern promontory of Titicaca Island, at Keñuani, and especially in two gardens on the island erroneously ascribed to the Inca, while they are both Spanish and of the eighteenth century, if not later. On these two lovely spots an abundance of European flowers and some vegetables, also strawberries, still thrive under the shade of imported and indigenous trees. On the peninsula of Huata similar spots are found; elsewhere vegetation is limited to the dismal Puna grass (*Stipa Ichu*) and smaller shrubs, some of which are used by the Indians in medicine and witchcraft.

Alimentary plants may be divided into two classes—indigenous and imported. Among the former the potato occupies the first rank. It is the leading staple of the mountain region in general. But cold and moisture prevent its preservation in the natural state. Combustible to dry the potato there is not enough; hence the only means to keep it is to let it freeze, then press out as fully as possible every trace of moisture, let it freeze again, and thus, reducing the tuber to a mere corklike, insipid mass, render it invulnerable against cold and humidity. The chuña, as this unpalatable metamorphosis of the (otherwise splendid) potato is called, is the main food on these highlands, and of all classes of society, without exception. Next to the potato comes the oca (*Oxalis tuberosa*), the quinoa (*Chenopodium quinoa*), maize, and the so-called papa liza, a most indigestible tuber of the potato kind. Imported alimentary plants are limited to barley and to a coarse, large bean, the haba. Vegetables would grow very well on the islands. We have seen, on Koati, plants that were almost arboriferous; but the Indian is far too conservative to change his diet. He prefers his primitive food, heavy and yet not nutritious, to wholesome aliments unknown to his ancestors.

Neither hill nor vale is without flowers. Along the lake and in sunny coves the kantuka—carmine, red, yellow, and white—droops from the branches among the vivid green foliage of a tall shrub. On humid expanses the panti-panti displays its white or pink blossoms. Verbenas cover the slopes in patches. Many an insignificant bush has a modest but pleasing little flower, and the quinoa presents, when in bloom, entire fields draped in the national colours of Bolivia—red, yellow, and green. On the other hand, miles and miles offer nothing to the eye but, along

the shores of the lake, lonely grey or dull green, with rocks intervening, or, in the interior, interminable levels of coarse Puna grass, dotted by the adobe or stone huts of the natives, their tiny fields, and an occasional drove of llamas.

Animal life is irregularly distributed. The middle of the lake sees occasionally a gull (*Larus serranus*) following the steamer. Of the six kinds of fishes thus far known few specimens appear on the surface. It is on the shores of bays like the large one of Achacache, on the waters of the picturesque harbours of the island of Titicaca and the peninsula of Huata, also on the roadsteads of Chililaya and others, mostly where the tatora or lake reed (*Malacochaete Tatora*) thrives in shallow places, that the aquatic birds of the lake are mostly seen. The choka (*Fulica gigantea*), a stately water-hen of black metallic plumage, with bright-coloured head and bill, glides quietly over the little-ruffled surface of the inner bays. Turbulent divers (*Podiceps*, *Tachybaptus*, and *Centropelma*) furrow the water around them like diminutive tug-boats, crossing and chasing each other with amazing rapidity. Along the mainland the flamingo and the rose-coloured spoon-bill are not rare, and a dark-green ibis stalks over marshy expanses. An ashy-grey night heron is sometimes seen erect on rocky points, and the black cormorant peoples smaller islands, affording the Indians, who visit them in frail balsas, a repulsive aliment in young birds and eggs with greenish yolks, both equally disgusting through their fishy smell and taste. A grey eagle soars over the rocks skirting the shores, and that handsome scavenger, the alkamari, stalks in pairs over fields and bare slopes. I forbear mentioning enigmatical beasts like the supposed seal, although there is enough in reports about the animal to excite legitimate curiosity. Neither do I dwell on the innocent toads, which the Indians gather and expose on dry rocks as often as they fear drouth. I also pass by the small scorpions, centipedes, and spiders, often disturbed by the opening of ancient sepulchres. But I cannot overlook the godfather of the island of Titicaca, the species of wild-cat to which the name is due. *Titi* means the lynxlike feline haunting the shores of the lake, from which, probably, it sometimes found ways and means of crossing over to the island. *Karka* (whence Kaka) signifies a rock, or cluster of rocks. The strangely situated cliff on the island, which was a shrine since time immemorial, is called Titi-Kala, or *stone of the cat*, since there are on its vertical face some concavities recalling heads of cats, on which the Indians looked with superstitious awe. Hence the wild-cat (called *Mulu-Mulu* along the slopes of Illimani) has given its name to the main island, whence, after the sixteenth century, it became generally applied to the whole lake. To-day still, the Aymará call the water-sheet simply *kota*—lake or sea. The Titi pays disagreeable attention to domestic fowl. During the seventeenth century its occasional appearance on the island gave rise to the well-worn tale of the carbuncle, a cat with fiery eyes and a luminous stone on its forehead. In former times the vicuña and even the guanaco were occasional visitors of the lake-shore, and they roamed through the districts west and south of the lake. The eastern shore, as well as the Andes, were and are,

especially the latter, frequented by the vicuña only. What we were told about the occurrence of the guanaco is problematic. I would also allude here to the not uninteresting fact that the condor, that huge bird of prey and carrion, while roosting in the Bolivian Andes about Illimani, is hardly ever a visitor of the lake or the plateau, whereas the easily domesticated Puna goose (*Bernicla melanoptera*) lives on one of the haciendas as tame as any ordinary member of the "civilised" species, and we had the daily visit of a pair of these handsome birds on the sandy shore of Challa, on the island.

Both the llama and the paca are kept in large numbers around the lake—the former as a beast of burden, the latter for its precious wool. Along the base of the northern range, on the dismal and cold levels that skirt the snowy peaks of Suchez, of Katantika, Kololo and Altarani and Ca, the paca pastures by thousands. They do not, however, go up near the mountain passes, where, as all along the snowy range, emerald-green lagoons, fed from the glaciers, offer a far better drinking water than any on the Puna. The vizcacha accompanies the vicuña to the highest crests, but it also makes its home on the Puna, wherever clusters of rocks protrude. So does the chinchilla, on the Puna nearer the Chilian frontier.

Since the Spanish occupation the Indian has additional domestic animals. He has the ass, the mule, the horse, and cattle and sheep. But he takes no care of them; hence the breed is poor and weakly. The llama and its kind, however, he fondles, for it is a time-honoured associate.

Outside of the city of Puno and a few unimportant villages along the lake, the white population hardly exists. Indians—Quichua in the north and north-east, Aymará to the south, and Mestizos—are the overwhelming majority. Intercourse with them—protracted contact—is far from agreeable, especially with the Aymará, who are a retrograde, stubborn, and naturally bloodthirsty stock. Distribution of the settlements is unequal. After sallying from the lagoon of Chucuito, where the village of the same name and that of Acora are the chief places, we pass successively Juli, Ilave, Pomata, and Yunguyu, leaving Zepita in the distance. All these villages together, and their surroundings, have to-day, according to Peruvian statistics, as many Indians as at the time of the Conquest. The Peruvian coast is low and monotonous; it fronts the widest part of the lake called Pampa de Ilave, where storms are much feared. Already there, the largest island of the lake, Titicaca, appears, seemingly connected with the peninsula of Copacabana facing it. As we approach, Titicaca detaches itself, assuming its true insular shape. It is about seven miles long, and has the form of an elongated toad. The lake makes not less than seventeen well-marked indentations into its shores, some of which are most picturesque bays. The backbone of the island is a long ridge, but the highest points lie outside of it—north-west and south-east. The former, Chullun-Cayani, overlooks the lake directly; the other, Pallasa, is off the shore, and both are 800 feet above the lake. The island is one of the most romantic spots imaginable, notwithstanding lack of vegetation. We

lived on it for over five months in all, and, with all the inclemency of climate and the evil disposition of the eight hundred Indians who live on the two haciendas into which the island is divided—with all their constant disobedience of most positive orders from the owners to respect and attend us as if we had been the proprietors themselves—this marvellous island, with its coves, its promontories, its unparalleled panoramas and outlooks, its modestly picturesque ruins, remains, and will always remain, the ideal of our dreams.

It is as if a reflex of its beauty had been cast on the peninsula of Copacabana, from which it is separated by the narrow channel of Yampupata. The sanctuary of Our Lady of Copacabana, famous in Bolivia since 1586 (although the once beautiful church was only begun in about 1640), stands on a lovely site; but, unfortunately, the village of Copacabana is a dreary hamlet, and only alive when the festivals of the Church gather thousands of boisterous Indians to dance in the plaza. Such dances are survivals to which the Indian clings with great tenacity, while their original meaning is only known to a small number of the aborigines. These celebrations, while attractive at first sight through quaintness and colour, become disgusting very soon through the carousals which form, and always formed, an indispensable corollary.

Copacabana has many natural charms. The triangle which the peninsula forms is as diversified in topography as odd in outline. Its Indian population is comparatively dense, of evil inclinations, and does not appear to have suffered any diminution since 1538. Tillage of the soil on a small scale and some cattle-raising give them occupation when their time is not taken up by feasting and carousing; and so it is all over Bolivia and the mountainous section of Peru.

Few lakes in the world have a greater number of islands and islets than Titicaca. Entrance to the bay of Chucuito is guarded by two large ones—Amantaní and Taquili, of which the latter has served repeatedly as a place where political prisoners were left to pine. Beyond the main island of Titicaca, towards the Bolivian end of the lake, lies Koati—green, almost treeless, but famous for its Inca ruins, not extensive nor architecturally remarkable, but well preserved and on a spot of unusual beauty, selected by the Indians for its warmth and because it faces the majestic summits of the Sorata chain, which are, to the Indian, very "big medicine."

Around Titicaca Island are a number of small isles, that appear like remnants of a former connection between the peninsula of Copacabana and that of Huata. The straits of Tiquina, very narrow, but not deep, and with steep, rocky shores, separate the two promontories. They also separate the main lake from the southern, comparatively very shallow, basins of Chililaya or Huarina, and of Uinamarca, at the south-western end of which opens the Desaguadero channel. Between the two basins lie a number of not unprepossessing islands, mostly inhabited. There are about thirty of them, many of which bear ruins of primitive settlements. South of the lake expands the bleak Puna, between twelve and fourteen thousand feet above the Pacific, and, at a distance of forty miles south of Chililaya, the cleft of the La Paz river opens, through which

that stream, hugging the mountain notch of Illimani, meanders to the basin of the Amazon.

Of the pre-Columbian condition of the inhabitants of Titicaca basin, many ruins, promiscuously scattered, bear testimony. Aside from those of Tiaguanaco, the past of which is still shrouded in mystery, ruins of Inca origin in the shape of more or less elaborate storehouses of stone and adobe, and ceremonial edifices of modest size on the island of Titicaca, on Koati, and around Copacabana—finally the many vestiges of Aymará occupation in the so-called Chullpas or dwellings with house-burial, on the Puna as well as in the mountains—show that, in pre-Spanish times, the lake region was occupied almost exclusively by Aymará Indians. These had, to a limited extent, been overcome by the Inca tribe of Cuzco, but never incorporated into a national or political union, of which no aggressive Indian tribe in America had any conception. These ruins indicate a population not in excess of the present number of Indians, but of a shifting disposition, to which Spanish rule put an end. The influence of the Incas was limited to levying tribute, and their architectural remains in the lake basin indicate permanence only in very few places.

THE TEACHING OF GEOGRAPHY IN THE SCHOOLS IN CUBA.

We give below the syllabus of the course of geography in the schools of Cuba, as an interesting example of a modern course in commercial geography.

A study of the syllabus will disclose several points of interest. The course is divided into five grades, each including three periods, but it is unfortunate that the ages of the scholars in the different grades is not given, so that it is not possible to contrast the course in detail with any of those suggested or in use in this country. It will, however, be noticed that the geography of the first grade is to a large extent synonymous with what is known as nature study here, and begins with simple object lessons on the immediate surroundings of the child. Throughout the whole course, indeed, geography seems to be regarded as a summary of the natural sciences, and it would be possible for a skilful teacher to make his course something of the nature of an introduction to the natural sciences, and by means of the supplementary reading enjoined in it to stimulate in his scholars a genuine love for more than one science, and a genuine appreciation of scientific method.

Again, in the two first grades the teacher is recommended to illustrate his subject by stories of life on land and sea, and in the earlier stages by the recitation of poetry. Obviously, therefore, there is here the opportunity of the teacher of literary tastes, who may correlate geography and literature, and stimulate the imagination of his class. In the higher grades, further, much stress is laid upon imaginary voyages, so that there are obviously possibilities in the way of developing the power of expression, and stimulating a taste for the reading of books of travel and exploration.

Throughout much stress is rightly laid upon manual work in connection with the subject—modelling, drawing, and map-drawing being all much emphasised. This being the case, it is somewhat remarkable that nothing is said of the formation of a school museum. Stress is constantly laid upon the necessity of direct observation, but in so extensive and comprehensive a course it is difficult to see how this can always be done unless there is either a school collection or the children have access to a good museum. It would seem that the course might very well be supplemented not only by encouraging the children to form collections, but also by making them construct simple forms of museum preparations for use in the classes.

It is hardly necessary to point out that the course is based upon a regional survey, and proceeds in the logical order from the known to the unknown. Here, however, as always, there is difficulty in bridging the apparent hiatus between local geography and that of the world at large. From the syllabus it hardly seems that the bridging in the present case has been very successfully accomplished, for we notice that the scholars seem to pass at once from a plan of the "block, quarter, or estate in which the school is situated" to a study of maps at large. Again, while observations on the setting and rising of the sun begin in the first grade, there is no mention of the globe till the third grade, and this although there is much to be said for the plan (recommended in the R.G.S. Syllabuses of Instruction in Geography) of allowing the children to become familiar with the globe from the first.

Finally, it should be noticed that the course is apparently intended to be used in the earlier stages as a vehicle for the conveyance of what the French call *morale*, and for the teaching of civics in the higher grades. Both these points are of great interest and importance, for there can be no doubt of the value of showing to the child, in connection with its formal work, the scientific basis of both morality and government, and as the object of the State is to make citizens, it can hardly be contested that the child should pass from the State school with not only a knowledge of the conditions, physical, social, and economic, into which he has been born, but also with a knowledge of how he may legitimately utilise the civic machinery provided by the labours of his predecessors, and of the ways in which his individual efforts may be directed for the welfare of the whole community.

In detail it would of course be possible to criticise many points of the syllabus, but we prefer here simply to call attention to its more obvious merits.

COURSE OF STUDIES ACCORDING TO THE CIRCULAR OF THE PRESIDENCY OF THE COUNCIL OF SUPERINTENDENTS OF PUBLIC SCHOOLS, 14th MARCH 1905.[1]

First Grade—*First Period.*—1. Direct observation of the forms of the *earth* which may be within the reach of the senses of the child, whether in the school or

[1] Translated from the *Boletin de la Real Sociedad Geográfica* (III. 4, p. 119). Revista de Geografía Colonial y Mercantil, publicada por la Sección de Geografía Comercial (Órgano official de la Sección Colonial del Ministerio de Estado).

outside of it. Flat country and broken country. The uplands. The different parts of these last. Drawing and modelling of the forms observed. Endeavour to reproduce or indicate the greatest possible number of details.

2. Simple lessons of observation on some domestic and wild *animals* of the neighbourhood. The same on some cultivated *plants*. On some wild plants. On some *stones*.

3. Direct observation of the *waters* to be seen from the school or outside of it —spring, stream, river, pool, swamp, lagoon, sea, etc.

4. Reproduction of some of these forms by drawing. The same by modelling. *Animals* which live in the waters observed by the child.

5. The child of the town and the child of the country. City and rural dwellings. Let these lessons be impressed by means of stories of interest to the children. Make use also of drawing and the exhibition of pictures (slides).

6. Let them observe the most salient characteristics of the white race, the black, and the yellow.

7. Direct observation of the *rising and setting of the sun*. The sun at midday. Take advantage of these observations to show the beneficent influence of the sun on the life of animals and plants.

8. Make the lessons pleasant by interesting stories. Let the pupils also sing, and recite simple songs, inspired by life in nature and the love of God.

Second Period.—1. Continue the lessons of direct observation on land forms and on water masses. Show, when possible, a cultivated meadow and an uncultivated. The plants and animals in both. Compare a meadow with a hillside. Continue the examination of uplands and their various parts, and give an idea of more elevated regions. Let the children reproduce the meadows and uplands observed in fullest possible detail on the modelling table. Use also slides or pictures.

2. Amplification of lessons on forms of water—springs, streams, etc.

3. The fruits of the season. Trees most common in the neighbourhood. Fruit trees; the wood of some trees. Other plants.

4. The commonest animals.

5. Simple lessons on the soil and its principal components.

6. Lessons of observations on the air. Use of the winds. Observations of phenomena due to atmospheric moisture— clouds, mist, rain, etc.

7. Observation of the weather. Let them note the days that are clear, dull, dry, damp, wet, cold, warm, etc. Give an idea of the seasons.

8. Continue the direct observation of the rising and setting of the sun. Teach the directions north, south, east, and west.

9. Life in town and country. City and rural dwellings. The roads in town and country.

10. Continue lessons of observation on black, yellow, and white races.

11. As before, render the lessons as pleasant as possible by stories and the recitation of poetry on the life of nature and of the Creator.

Third Period.—1. Amplification of lessons on forms of land and water, both in the school and away from it. Meadows and hillocks. Different parts of the hillocks or hillsides. Idea of hills, mountains, and valleys. Comparison between mountain and valley, plains and fields. Plantation, wood, and thicket. Stories which take place in forests, mountains, plains, etc. In addition to direct observation, use drawing and modelling.

2. Continue lessons on the soil and its components.

3. Animals and plants of the plains, the mountains, the valleys, etc. Animals useful and hurtful.

4. Fruit trees of the season. Other useful plants. Woods for building, carpentering, etc. Quarries.

5. Forms of water—spring, river, fen, etc. The shore of the sea. The beach and the coast. Stories of events which take place on the water and its neighbourhood.

6. Amplify lessons which compare town with country life. Occupations most common in city and rural populations. The tasks of the field. Elaboration of sugar and tobacco. The reason for exchange. Means of travelling and transport of merchandise. The postal service. Simple idea of religion and government.

7. The air. The wind. Observations on clouds, fog, and rain, also dew, etc. Idea of snowfall and frost.

8. The seasons. Register of the weather.

9. Amplify lessons on rising and setting of sun. The Pole Star. Continue lessons on orientation—north-east, south-east, north-west, south-west.

The *plan* of the lecture hall, and, if possible, of the school.

Second Grade.—*First Period.*—1. Forms of the land. Level tracts, high and low. Table lands, meadows, plains and plantations.

2. Uplands. Their various kinds. Different names of the uplands (hillocks, knolls, hummocks, slopes, etc.).

3. Greater elevations of land (mountains and hills).

4. Dales and valleys. Fissures and gorges. Caves and grottoes. Give examples, first in Cuba, then in other countries.

5. Lessons of observation to make them understand the origin of springs, streams and rivers. The direction of waters. Filtration. Permeable and impermeable soils. The action of currents.

Illustrate the lessons by means of drawing and the modelling table.

6. The sea-shore. Coasts and beaches. Fishes, molluscs, sea-birds. The colour and taste of sea-water. The bottom. How sand is formed. The navigation of the sea.

7. Simple narratives illustrating the different occupations and habits of men who live in cities, in the fields, in valleys, in the mountains, in the neighbourhood of forests, on the banks of rivers, or by the sea. Mode of living of agriculturists, fishermen, hunters, etc.

8. Animals and plants worthy of study in each of the regions indicated. Mines and quarries.

9. Sketch of the most salient characteristics of the three races indicated. Study also those of the copper-coloured (redskin) or American Indian.

10. Continue the lessons of observation of the rising and setting of the sun. The same of the moon. Point out the Pole Star and the Great Bear.

11. Revision of Orientation. Idea of the compass. Plan of the lecture hall and of the school. The same of the block, quarter, or estate in which the school is situated.

Second Period.—1. Continue the study of the plains. Idea of deserts and oases. Point out on the map one of the great deserts, and by means of an interesting narrative, explain the mode of life of the men and animals which are found there. Give some idea of a caravan.

2. Continue the study of uplands, and of hills and mountains. Idea of mountainous areas, ranges, chains, ridges, &c. Tablelands. Woods and groves.

3. Amplify lessons of observation on the origin of springs, streams and rivers. The beds of rivers and streams. Rounded stones, pebbles, gravel and sand. Formation of banks, deltas, &c. Drainage, the outlets of rivers and streams.

The use of currents. Means of crossing the currents—fords, rafts, ferry-cables, bridges, etc.

4. Coasts and beaches. Ports and bays. The bottom of the sea. Phosphorescence. Lighthouses, wharves, &c. Observation of the waves. tides, etc.

5. Islands. Exhibition of the map of Cuba. Mention of other important islands.

6. Vessels, sailing and steam. Idea of maritime commerce.

7. Inland ways of communication. Idea of inland commerce.

8. Narratives to illustrate the life of the inhabitants of the various parts of the country. Cultivators of sugar-cane and coffee. Woodcutters, herdsmen, fishermen, miners, factory hands.

9. Narratives to illustrate life in other countries. Compare with the life in ours. Point out on the map the countries to which such narratives refer.

10. Indicate on the map the continent of America, and its most notable islands.

11. Sketch of the map of the province in which the school is situated.

Third Period.—1. Continuation of the study of plains, mountains, valleys, streams, torrents, rivers, fens and lagoons. Idea of lakes. Point out on the map some well-known lakes, both fresh and salt.

2. Coasts, capes and points. Ports, bays, creeks, &c. Straits and canals. Islands. Peninsulas and isthmuses. Lighten the study by stories showing life in the various places.

3. Study of the map of Cuba. Meadows, mountains, and rivers which are most notable. Sea coasts. Capes and principal points. Adjacent lands. Straits and canals. Point out the countries nearest to Cuba, and indicate their relations with her. Idea of the principal products of our country. Give preference to those in the province in which the school is situated. Religion and government of Cuba). The most famous cities of Cuba.

4. Continents. Parts of the world. Oceans, seas. The Atlantic Ocean and the Caribbean Sea. The most notable ports of Cuba. The same of America. Point out those in most constant communication with the island.

5. Continue the study of the human races.

6. Observation of the Pole Star, the Great Bear, and the phases of the moon.

THIRD GRADE.—*First Period.*—1. The earth considered as globe or sphere. Direct observation of the visible horizon. Principal divisions of the earth. Begin the comparative study of continents and oceans. East and western hemispheres. The same north and south. Idea of the equator, of the meridian and the poles.

2. Amplify lessons on the forms of land and water, on the meteorological phenomena and on orientation. When the study is not direct, make use of drawing, the modelling table, the display of pictures, and reading, both supplementary and textual. Introduce the study of volcanoes and earthquakes. Idea of marine currents. The Gulf Stream. Those forms which are observed directly should be taken first. Lighten these studies as much as possible in the manner indicated.

3. Division of the earth into zones. Information about the climate and products characteristic of each zone. Do not take notice yet of the polar circles, nor of the tropics. Climate and products of Cuba.

4. Amplify lessons on the races and their general distribution, also on agriculture, industries and commerce. Explain the subject of imports and exports. Idea of Customs duties. Races which inhabit Cuba. Preliminary notions about the agriculture, industries, commerce, government and religion of Cuba.

5. Sea coasts of Cuba. The most notable plains and mountains. Watersheds. Principal rivers in the north and south. Cascades and waterfalls. Valleys, lagoons, marshes. Forests. Study more carefully such as are in the province.

6. Sketch of the map of the province. Same of the map of Cuba.

Second Period.—1. Revision of the previous period with regard to the general study of the earth ; its great divisions ; forms of land and water ; the meteorological phenomena ; its inhabitants. Continue the comparative study of continents and oceans. Marine currents.

2. Amplify the lessons on the physical and political geography of Cuba. Introduce the study of the principal means of communication used in the country. Railroads and carriage roads, especially those which traverse the province. Let the pupil make a tracing of these on the map. Postal and telegraphic services.

3. Detailed description of the city, town or village in which the school is situated. The same of the most famous ones in the province.

4. After considering the map of America as a whole, study that of North America in its most salient details, more especially the United States, Mexico and the Antilles. The commerce of Cuba with these countries, especially with the United States.

5. Sketch maps. That of the province ; of Cuba ; of North America.

6. In that of the province, and in that of the Island of Cuba, the children should point out the different places as they name them.

Third Period.—1. Amplification of the study of the terrestrial globe and of its inhabitants. Civilisation. Its different degrees. Introduce interesting lectures on the life of savage peoples, semi-civilised, &c. Compare the life of some of these peoples with ours. The most famous peoples of the earth.

2. Continue the comparison of the continents with one another. The same of the oceans. Marine currents.

3. Continuation of the study of North America, and of its relations with Cuba. Describe imaginary journeys in the United States, Canada, Mexico and the Antilles. Sketch the map of North America, and name the most notable places.

4. Study the map of South America in its most salient details.

5. Amplification of the physical and political geography of Cuba. The principal divisions of Cuba.

6. Description of the cities and most notable places in each province. Tracing of the map of Cuba, and of one or more provinces.

Fourth Grade—*First Period.*—1. Movement of the earth on its axis (rotation) ; day and night. In which direction does the earth turn ?

2. Revolution of the earth ; the year. Ordinary and leap years. Civil year. The seasons. Seasons in the tropics, in the temperate zones, and in the Arctic circles. Seasons in Cuba. These lessons to be given with the greatest simplicity.

Geography of Cuba.—Revision of the physical and political geography of Cuba. Detailed description of one province. Group together the following :—

1. The climate. Temperature. Rains. Seasons. Winds. Cyclones. Electrical disturbances.

2. The soil and rocks. Mineral wealth. Materials for construction. Mines.

3. Plants : their applications. Fruit trees. Woods used for building. Sugar cane, tobacco, coffee, cacao. Textile plants. Garden stuffs and the lesser fruits.

4. Animals. Indigenous mammals. Acclimatised mammals. Birds, useful and noxious. Reptiles. Fishes. Molluscs and zoophytes. Sponge-fishery. Insects, useful and harmful. Apiculture.

Universal Geography.—Amplification of the study of the map of North and of

South America. The flags of the independent countries. Tracings of the maps of North and South America. Imaginary voyages to the various countries; point out on the map the districts visited. Supplementary lecture on the most important countries, especially those which are most intimately connected with ours. Employ drawing, the modelling table, and pictures.

2. Exhibit the map of Europe, and study its most salient points.

3. In this grade, as in the following, lay more stress on the intimate relation between the geographical characters of some regions, and the activity of the human life therein. For instance, the low lying lands lend themselves to agriculture and the pastoral life; good harbours to commerce; places in which there is coal and hydraulic force, to manufactures, etc.

Second Period.—1. Revision of the last period. Duration of the days and nights in the equator, in the polar regions, and in the intermediate area. The days and nights in the northern and southern hemispheres. The days and nights in Cuba.

2. Idea of geographical latitude.

3. Revision of the characteristic climates and products in the different zones. Compare the life in some cold and temperate countries with the life in ours.

Geography of Cuba.—1. Revision of the last period. Detailed description of a province different from that already studied, and besides:—

(1) The various industries of Cuba.

(2) Population. Primitive race. Actual population of the island. Distribution of population.

(3) Government. Executive, legislative and judicial powers. Divisions: provincial, judicial, municipal, etc.

(4) Imaginary journeys along the coast north and south of Cuba. Description of the different ports, of the cities and the coast. Special mention of the Isla de Pinos.

2. Utilise the map, and sketch those of the provinces already studied.

Universal Geography.—1. Revision of the lessons on North and South America.

2. Study of the map of the following nations of Europe: England, France, Germany, Spain and Italy. Flags. The most notable cities and ports. Relations of these countries with Cuba. Imaginary voyages as before. Point out in the map the places travelled over, or which are mentioned.

3. Sketch of the map of Europe.

Third Period.—Revision of the two last periods. Seasons and climates. Causes which influence the modification of climate. Continue the comparison of the life in other countries with that in ours. Idea of geographical longitude. Method of finding the longitude and latitude on globes and maps. Employ both the celestial and the terrestrial globes.

Geography of Cuba.—1. Revision of the two last periods. Detailed description of a province different from the last two already studied. Sketch its map, and besides:—

(1) Public instruction, primary, secondary, and superior education; academies, etc.

(2) Communications. Railroads. Carriage roads. Lines of steamers. Telegraphic and telephonic communication. Postal service.

(3) Home and foreign commerce of Cuba.

(4) Imaginary journeys through the interior of the island. Special mention of the principal cities and regions traversed. The pupil ought to know the various

methods of travelling from one place to another, and to indicate on the map the places mentioned.

Universal Geography.—1. Revision of the study of North and South America.

2. Revision of the study of the maps of England, France, Germany, Spain, and Italy. Supplementary lecture on these countries. Imaginary voyages. Point out on the map the places mentioned. Make use of pictures.

3. Superficial idea of the rest of Europe.

4. Sketch of the map of that part of the world.

Fifth Grade—*First Period.*—1. Observation of the Phases of the Moon. Make use of slides and drawings. Observation of the most important constellations.

2. The atmosphere. Observation and experiments. The most important instruments. Exhibit and demonstrate their use.

Geography of Cuba.—Detailed description of the three remaining provinces. Make reference to the most important historical places. Indicate on the map every place that is mentioned. Imaginary journeys. Supplementary reading.

Universal Geography.—Revision of what has been already learned with regard to America and Europe. Show the map of Asia. Study of the most salient characteristics. The most remarkable regions. Special mention of China, Japan, India, Asia Minor, and Arabia. Compare the life in these countries with that in ours. Make the same comparison with regard to the climate and products. Sketch of the maps of America, Europe, and Asia.

Second Period.—Phases of the moon. The most notable constellations. Winds. Their causes. The most notable forms of Wind. The reigning winds in Cuba and other countries. Utilisation of ærial currents.

Geography of Cuba.—Amplification of all that has been already learned. Supplementary lectures and reading. Trace the map of Cuba with the greatest amount of detail. Remind the scholars of the most notable historical places.

Universal Geography.—Revision of the last period. Exhibition of the maps of Africa and Oceania. Study the most notable countries, as with other parts of the world. Sketch of maps and supplementary reading.

Third Period.—Revision of the previous period. Study of meteorological phenomena, aqueous and igneous. Direct observation and information about them.

Geography of Cuba.—Revision and amplification of all already learned. Imaginary voyages. Tracing of the map of Cuba with great detail. Supplementary reading. Remind the pupils of the most remarkable historical places.

Universal Geography.—Revision and amplification of all that has been learned. Imaginary voyages. Tracing of maps. The flags of the principal countries. Relations of Cuba with the different nations. Supplementary lectures. Do what is possible to make the pupils understand that the social conditions and the development of the commerce and industries of a country depend largely on its geographical position, the nature of the soil, the climate, the natural products, the facilities of communication, etc.

Point out the conditions of Cuba which are most advantageous, and indicate that if the enlightened exertion and the perseverance of her sons co-operate with these actively, and if also a large amount of common sense and morality is displayed, the future of our country is bound to be enviable.

THE ALEXANDER-GOSLING EXPEDITION.

FURTHER letters from the members of this expedition have been received, dated respectively from the River Shari, May 26, and from Fort Lamy, June 14. It will be recollected that, at the time when the last news of the expedition was received (cf. our July issue, p. 383), the party was preparing to go by boat across Lake Chad, with the intention of ascending the Shari. The letters recently received, which form the basis of an article in the *Times* of October 9, show that the navigation of Lake Chad has proved extremely difficult, Lieutenant Alexander's further observations apparently confirming those which he made earlier (cf. p. 215) that the lake is largely overgrown and in process of drying up.

At the outset the intention was to proceed to Kussuri, to the south of Lake Chad. Lieutenant Boyd Alexander had been able to get together a sufficient number of bullocks to carry the heavy loads by land to Kussuri, and these left the camp at Kadde (which is close to the lake and about twenty miles north of Kuka), with Captain Gosling on February 12. A few days later Lieutenant Alexander left with the collector Lopes in the two boats to find a waterway from Kadde to Kussuri. From his previous experience of the shallow water of the lake, Lieutenant Alexander decided to strike a course from the Yo mouth and so follow, if possible, the influence of the deep water. He reached the Yo mouth on February 27. The river was still running, but had fallen considerably, and in places it was fordable. His journey to the Yo mouth gave him some confidence, as he found open water with an average depth of three feet. From the mouth he struck in an easterly direction, and all went well for two days, during which he covered approximately twenty miles. But on the third day trouble began, for it was not possible to find more than a foot of water covering unfathomable thick mud. Lieutenant Alexander managed to pull the boats over this for long distances, the men holding on as they pushed to the gunwales of the boats. But it was a hopeless task; he could find no open water, nothing but a mass of small islands, which formed innumerable shallow bays. These islands are not of large extent; their average length does not exceed a mile. They are low, of a sandy soil, and covered with scrubby bush-growth and reed, not a few being fishing-stations of the Buduma, where they dry their fish. On the larger ones there are cattle-stations, which consist of reed-built huts of Kaffir kraal shape, very small in circumference and not more than four feet high.

Lieutenant Alexander tried on several occasions to get hold of a Buduma guide, and eventually got one after several hot chases after their canoes; but he showed the most stolid reserve, and nothing could be got out of him. It was most disheartening work, finding sufficient water for the boats one day, to see them next morning nearly high and dry in the mud. This generally, but not always, occurred after a strong wind from the north-east. At night the water, regardless of any wind, used frequently to fall, and by the early morning it had fallen six inches,

and then towards midday it would commence to flow again and be at its full about three o'clock. On several occasions Lieutenant Alexander found currents running in a south-easterly direction and at a rate of one mile an hour. In his struggle to get across the lake, one of the worst things he had to face were the mosquitoes, which swarmed in clouds. Very often the party could not land at night, and found themselves cooped up in the boats, a prey to these horrible insect hordes. They sat huddled together and longed for the morning to come. Many of the men preferred sitting in the water all night.

On March 20 the party returned to Kadde, and made preparations for a second attempt in a due easterly direction from this place. But the same ill-success was met with, no water being found after fifteen miles, only groups of small islands, behind which was a long tract of land running in a north-westerly direction which they were unable to skirt. This, Lieutenant Alexander fully believes now, forms the east coast of the lake. To the south this land bends round in a semicircle to within five miles of Kadde, where dense masses of reeds connect it with the mainland. Lieutenant Alexander has now no doubt whatever, and the Budumas tell him the same thing, that this land divides the lake in two, and there is no water communication between the two sides.

He made an attempt to cut his way through the reeds just spoken of, but the growth was so dense that he had to give it up and return again to Kadde, where no other course was left to him but to take the boats to pieces and carry them to a Buduma fishing-station close to the lake and lying about eighteen miles to the north-east of Koa [Kaia?], where he found out that the water was more open. What with sickness and desertion, he found himself left with only seven men. He could get no labour at Kuka. It was a most tedious task carrying these heavy sections with so few hands for a distance of thirty miles, over nothing but rough grass and marsh land. It was a good month before he could get everything up to the fishing-station and the boats put together again. The Budumas call this place Seyurum,[1] and they say it was once an island, but is now part of the mainland. On reconnoitring the water near this place Lieutenant Alexander found that this seemingly open water, averaging a depth of four feet, was nothing more than a large bay enclosed on every side by great belts of reeds five feet to six feet high, and clumps of maria bush growing out of water two feet to three feet deep. There was nothing for it but to cut a road for the boats. A day's cutting through the reeds in a north-easterly direction brought him out again into another large bay of the same aspect as the first. The next cutting he had to do was far the most serious one. It took him two days to do it, but after that he found pretty deep water, averaging a depth of five feet. There was now a clear road between the British side and Kanem, with water sufficient for a launch drawing two feet. Up to this time the Budumas had held severely aloof, but, probably owing to the fact that the expedition had effected an entrance

[1] On the War Office map this is marked Seyorum, and is indicated as an island.—Ed. *S.G.M.*

into their country, a Kachella, or chief, of a large fishing-fleet they met came forward and offered to show them the road to Bul, a French station on the Kanem coast. After their hardships they jumped at this very readily. Lieutenant Alexander found that the path he had cut was about two miles above that of the Budumas, through which they get their fish and potash to the Bornu side; but they are such timid and suspicious people that they would never divulge the whereabouts of this road. After getting out of the thick reed-belts, the lake presented quite a different aspect from that of the Yo side. From the small, low, flat islands of the latter, the lake gave way to big island stretches, causing the party to follow a channel, which sometimes was not more than a hundred yards wide, though at other times it formed bays as much as two miles in width, their sides lined with belts of maria ten feet to thirty feet in height. The dark green of the maria foliage was relieved by masses of reddish brown—the dead feathery branches of a thornless acacia which grows on these islands.

A day from the reeds brought them to Karraragga, the island of the Kachella, who took them to his town—a rather pleasing event after the struggle of nearly two months. This island presented a fertile appearance. It is covered with a growth of several species of acacia, and has big belts of maria close to the water, while the grass affords excellent pasture for cattle, which the Budumas keep in large numbers. Its aspect was certainly pleasing; everything looked fresh and green, a great relief to the eye after the sand-swept stretches of Bornu. This Kachella's town consisted of reed-built huts, conical in shape right down to the ground. Each hut had its mosquito-house, which consisted of low, round huts covered with close-woven matting. The heat at night in these shelters must be appalling. The Budumas all speak Kanuri or Beri-Beri. They come very close to the Kanembu from the Kanem side, with whom they intermarry. They are tall men with well-developed heads and foreheads and blunt noses, and, living as they do on fish, their skins are very sleek and oily. In dress, the big men wear the loose-fitting, dark-blue toga of native cloth, common in Bornu, which they get in return for their fish in the Koa market. The women are small and in their head-dress resemble the Kanembu; well-oiled plaits of hair hang down all round their heads, while on the crown is a raised ridge down the centre much like that of the Fulani women. They ornament these twisted curls of hair with shells and silver rings. They wear necklaces of beads, chiefly white, a colour to which they are very partial.

The Budumas are not a fighting race. They are timid, and a good deal of Lieutenant Alexander's trouble has been in trying to make friends with them. As soon as they catch sight of a white man, they are off in an instant, driving along their canoes at a prodigious rate. None of the older men do the poling; youths and small boys do all the work. The canoes are most picturesque, especially when numbers are seen together, which is generally the case, visiting as they do the fishing grounds in large fleets of from twenty to thirty boats. Their canoes are made of dried reeds, bundles of which are tied together, and the whole again more strongly tied together so as to form the construction of the

canoe. They are turned up at the prow, and remind one forcibly of the Italian gondola. They are very seaworthy. A good canoe, which takes a month to construct, will last as long as two years. Their size varies from six to eighteen feet in length, and about three feet wide, the smaller ones drawing about a foot; they are for the shallow water and in cases of emergency. The Budumas catch the majority of their fish in nets, but the longer ones of three feet and upwards in length are speared. Most of the fish are cut open, splayed and dried in the sun, and in this condition are taken to the Bornu markets. The Budumas on the Shari side are a much more enlightened lot of people than those on the Yo-Chad water. The former despise and have nothing to do with the latter. The Budumas on the Yo side are certainly what are called there a bush people; and from what Lieutenant Alexander can make out, they come from a country called Kologo, in the north-east of Kanem. They are nothing more than robbers and slave-dealers, and as long as they are allowed to remain untouched, there will be an open door to slavery in its grossest form from Bornu.

The Budumas have their chiefs, who are called Kachellas, while over all these is their king who is called the Korammi. They are well-to-do people deriving their wealth from trade in potash and dried fish. In the Koa market a fish weighing 10 lbs. will fetch as much as a dollar. The potash is made into flat, cone-shaped blocks, weighing about 40 lbs. each, which are sold eight to the dollar. A distance of ten miles from Karraragga brought Lieutenant Alexander to a place called Wunnda, a Kanembu town on the Kanem coast. It came as a great surprise to him that he was able to reach the other side of the lake in practically two days; and he estimates the distance approximately at not more than twenty miles, so that a boat can reach the Kanem side from Koa in a day. He was very much puzzled and could make nothing out of the existing map. Shrinkage of the water must have a great deal to do with it. All the islands he passed are now in many instances practically one; great belts of reed and grass join them, which, according to what the Budumas tell him, two years ago did not exist. At Wunnda he found a large amount of potash which comes a five days' journey from the Kanem country. All this potash is taken by the Budumas in their canoes to the Bornu markets, where it forms the basis of a very lucrative trade.

From what Lieutenant Alexander has seen of Kanem it looks a most desolate country, and the French officials are not very enthusiastic over it; nothing but sand-dunes covered with scrubby acacia growth, whose branches are whitened by the wind-swept sand. All the towns he stopped at are in want of food, and it was with difficulty he could get any for his men. From Wunnda he got to Bul, a French station on the Kanem coast, lying about eight miles south-east of Wunnda. From this place, after skirting the Kanem coast for a distance of twelve miles, Lieutenant Alexander struck in a westerly direction; this course was difficult, winding through belts of maria that frequently approached each other and gave the waterway a width of not more than a hundred yards. In these channels he found nine feet to twelve feet of water.

After a distance of ten miles he got into more reed-growth, through which he had to cut a path for the best part of a day. After this the water again became more open with long island belts of tall maria trees twenty feet to thirty feet in height. The water averaged a depth of three feet with a muddy bottom. Here his Lake Chad troubles ended, and he arrived on May 25 at the Shari mouth after a three months' knocking about on the lake.

Lieutenant Alexander has made an interesting collection of birds of the islands. They differ very considerably from those he collected in Bornu. The Shari is described by Lieutenant Alexander as a magnificent little river, but cannot be compared with the Benue in size—the average width being five hundred yards—but unlike the Benue it is quite free of sandbanks, which is a great thing for navigation.

Lieutenant Alexander and Captain Gosling were leaving on June 15 for the Gribingui and the Tomi, whence a portage of six days will bring them to the Ubangi, which they hoped to reach by the end of August.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

At a Meeting of Council held on October 11, Major W. Lachlan Forbes, late of the Royal Fusiliers, was appointed Secretary of the Society. Major Lachlan Forbes succeeds Major Lindsay Forbes, who was appointed on the resignation of Lieutenant Shackleton in July last, but was prevented by ill-health from taking up the duties of the office.

Major W. Lachlan Forbes has had a distinguished military career, having taken part in the Afghan Campaign of 1879-80, including the Defence of Kandahar and the battle of September 1, served during the Burmese war of 1885-87, and fought in South Africa, where he was severely wounded at Elandslaagte. He has travelled much, having accompanied his brother on a visit to the Zambesi and Central Africa, and having been through Ceylon and Southern India. As a canoeist he has navigated several of the great rivers of Europe.

At the same Meeting of Council, the Livingstone Gold Medal was awarded to Sir Archibald Geikie, D.C.L., LL.D., F.R.S., for his distinguished contributions to geographical science, notably to the physical geography of Scotland.

The Society's Silver Medal was awarded to Mr. R. C. Mossman for his distinguished services as a member of the Scottish National Antarctic Expedition, also to Major Ryder, R.E., of the Tibet Expedition, and to Major Gibbons for his explorations in Central Africa.

It was also decided to hold a banquet to celebrate the twenty-first anniversary of the Society.

OBITUARY.

Rear-Admiral Sir W. J. L. Wharton.—Our readers will regret to learn of the death at Cape Town of Admiral Sir William Wharton, whose presidential address to Section E of the British Association we printed in our last issue. It was while in South Africa for the purpose of attending the meeting of the British Association that death took place.

Admiral Wharton was born in 1843, entered the navy at the age of fourteen, and soon showed himself especially interested in the work of surveying. In 1872 he was appointed to the surveying ship *Shearwater* for service in the Mediterranean, and afterwards on the east coast of Africa. In both places he did excellent work, especially in connection with the study of the surface and under currents of the Bosphorus. Later, he carried out further surveying work in the Mediterranean, Red Sea, and off the east coast of Africa in the *Fawn*, and in the River Plate and the Straits of Magellan in the *Sylvia*. At the early age of forty-one he was appointed hydrographer to the Admiralty, a post which he held until his health compelled him to retire in 1904. He was a Fellow of the Royal, Royal Astronomical and Royal Geographical Societies, and in connection with the last-named especially did a great deal of work. In 1893 he edited the journal of Captain Cook during his first journey round the world, and his work on *Hydrographical Surveying* is a standard book on that subject.

On September 14, the famous explorer and administrator, **Count Savorgnan de Brazza**, who had so much to do with the founding of the French Congo, died at Dakar. M. de Brazza, though a naturalised Frenchman, was of Italian parentage, and was born at Rio Janeiro in 1852. He was a student at the Marine College, Brest, and in 1875 was sent, accompanied by Dr. Ballay and M. March, to explore the Ogowai river in Western Equatorial Africa. The expedition lasted three years, and in the course of it the Upper Ogowai was explored, as well as certain of the tributaries of the Congo, and a large extent of previously unknown country. On his return to France, at the close of the expedition, de Brazza heard of Stanley's discovery of the Congo, from which he himself, though unaware of the fact, had only been five days' journey, and in December 1879 he again returned to Africa. Ascending the Ogowai, he founded the station of Franceville, placed 500 miles from the coast. From Franceville he pushed his way across to Stanley Pool, on whose north shore he founded the station known by his name (Brazzaville). The second return to France took place in 1882 when de Brazza met with a great reception in Paris, both at the hands of the government and of the learned societies. Returning again to the Congo in the following year he established a series of stations between the Congo and the Gabun, while a little later diplomacy confirmed France in the possession of nearly all that de Brazza had claimed for her, and this in spite of strenuous opposition, notably from Stanley.

The chief other piece of exploring work performed by de Brazza was an expedition in 1891-2 which had for its object the establishing of a practical route to the Shari and Lake Chad, after which the explorer retired to France.

In April of the present year he was sent out as Commissioner to investigate certain charges against the administration of the French Congo, and it was on his return from this mission that his premature death took place.

On September 13, there took place at Harrogate the death of **Captain J. Wiggins**, a seaman and explorer whose name is associated with the navigation of the Kara Sea. The motive of his work was practical and commercial rather than scientific, but its result was to establish a new highway of commerce which for a time had considerable importance, and which seems likely to come again into use. In the year 1874 Captain Wiggins succeeded in navigating the Kara Sea for the first time since the seventeenth century, and in finding a passage between Nova Zemlya and the mainland by which access could be obtained, during the two summer months, to the great Siberian rivers of the Yenisei and the Obi, though he was not able to ascend either of these rivers. The journey was repeated in 1875 still without complete success, but finally in 1876 the commercial value of the route was proved by a further expedition, during which the Kara Sea was not only navigated without accident, but the cargo of the vessel was discharged successfully at various points in the estuary of the Yenisei, the vessel reaching a point 900 miles from the estuary. For some years a promising trade was carried on by the new route, but a failure to penetrate the ice in 1899, combined with fiscal changes at the ports of discharge, led to its cessation, the opening of the Trans-Siberian railway being a contributing cause. Some months ago, however, the Russian Government sent a cargo of supplies to Siberia by this route, and this announcement was followed, within only a few days of Captain Wiggins's death, by a statement of the intention of the Russian Government to once again open the town of Yeniseisk, placed 1000 miles up the Yenisei river, as a free port. It is quite possible that this may be followed by a revival of the Kara Sea passage as a trade route.

Captain Wiggins was a Fellow of the Royal Geographical Society.

We have also to record the death of Ferdinand, **Baron von Richthofen**, Professor of Physical Geography in the University of Berlin, which took place on October 7, at the age of seventy-two years. Professor von Richthofen was born at Karlsruhe, in Silesia, and was trained as a geologist. His earlier works were geological in character, and comprised papers on various Alpine districts, on the mountains of Hungary and Transylvania, and on the metalliferous chains of California and Nevada. He travelled very extensively, especially in the East, where he made no less than seven journeys into the interior of China. The result was his great book on China, which is still the standard work on the subject. In 1872 Richthofen returned to Germany, and

held successively professorships in geography at Bonn, Leipzig, and Berlin (1888). Besides being the president of the German Geographical Society for a prolonged period, he was founder and director of the Berlin Hydrographical Institute.

GEOGRAPHICAL NOTES.

EUROPE.

Report on the Progress of the Ordnance Survey.—We have recently received this Report for the year ending March 31, 1905, and summarise below the chief facts which it contains in regard to the progress made with the different maps of Scotland during the year.

The Cadastral Survey on the 1/2500 *Scale.*—During the year under consideration, the revision of the counties of Elgin, Nairn, Ross, and Cromarty, and Sutherland has been completed. The total area of the revised maps on this scale now published is 10,374 square miles, of which 557 square miles have been published during the year, as compared with 713 square miles during the year 1903-4.

Scale of Six Inches to a Mile.—The total revised area now published on this scale is 20,943 square miles, of which 703 square miles have been published during the year under consideration, as compared with 2112 square miles in 1903-4.

Scale of One Inch to a Mile.—The following figures represent the progress made with the field revision of the second revision of this map :—11,993 square miles have been revised and drawn, 7034 square miles engraved, and 5562 square miles published. The progress during 1904-5 is indicated by the following figures :—4580 square miles, revised and drawn, 4111 square miles engraved, 4907 square miles published. Of the 1-inch coloured map of Scotland, 1357 square miles have been published during 1904-5. The sale of 1-inch sheets as parish indexes with the civil parishes coloured has been so small that the preparation of these indexes has been discontinued, and county indexes are being prepared which will be cheaper, and it is believed more convenient.

Scale of Two Miles to the Inch.—A map on this scale has been authorised, and drawing has been commenced.

Scale of Four Miles to the Inch.—The publication of the hill-shaded edition, printed in colour, of this map has now been completed, and is in style similar to the four-mile map of England. It is printed on thick paper, but a thin paper edition is being prepared, which will be issued in a cover, also mounted and folded. The price is 1s. a sheet on paper, and 1s. 6d. a sheet mounted. On this scale county and district maps are also printed on thin paper with coast and inland water in blue, and main roads coloured burnt sienna. They can be procured folded in a cover for the pocket.

Map of Great Britain on the Scale of Ten Miles to an Inch.—This map has been completed and published in two forms : (1) in outline with coast water in blue ; (2) in colour with hills. It is divided into twelve sheets, but by combining the smaller sheets on one sheet of paper, the coloured edition is printed on only eight sheets of paper. These are sold at 1s. each. This map can also be obtained mounted on linen as a wall map for 21s., or mounted with rollers for hanging for 30s. This map has hitherto only been issued printed on thick paper

and flat, but it is proposed now to also issue the sheets folded in covers for the use of motorists and others. Price 1s. on paper folded, and 1s. 6d. mounted and folded.

Map of the United Kingdom on the Scale of 1,1,000,000.—This map has now been completed and published. It shows outlines and names in black, coast water blue, and hills in brown. It is printed in two sheets, and is sold on paper for 5s., or mounted as a wall map for 10s., or mounted with moulding and roller for 20s.

Town Surveys.—The re-survey and revision of Ayr on the 1/1056 scale are in progress.

As regards the sale and distribution of the maps, it is noted that the sales, having remained practically stationary for the three years preceding 1904-5, showed a very considerable falling off during that year. This falling off occurred entirely in the large-scale maps, the sales of small-scale maps showing a small increase. The sales through the medium of the Post Office are so small that the Report states that it does not seem worth while to continue this method of distribution. To mention figures, it is of some interest to note that the total sales of Ordnance Maps for Scotland for the year from April 1, 1904, to March 31, 1905, is only a little over £3000, as compared with a grand total for the United Kingdom of nearly £40,000, and a total for Ireland of nearly £6000—figures which either argue a great indifference to local geography on the part of the people of Scotland, or a preference for other sources of supply of maps than the Ordnance Survey Office. Considering the yearly rush of visitors to the north, the latter is the more probable explanation.

Africa.

African Exploration.—Mr. W. M. M'Millan, the well-known American traveller, who has already conducted several expeditions in Abyssinia and the Anglo-Egyptian Soudan, started in the latter part of September on a further expedition to Africa, his destination in this instance being, in the first place, the British East Africa Protectorate. He will be accompanied as before by Mr. Bulpitt and Mr. Jessen, the latter of whom is a trained and skilful surveyor, who has already done much excellent work in the region of the Blue Nile. During the past few months Mr. Jessen has executed a survey of an extensive region lying on either side of the frontier between Abyssinia and the Anglo-Egyptian Soudan. This work has resulted in the mapping of a large part of the course of the Didesa and the little-known tributaries of the Blue Nile. The maps which Mr. Jessen has prepared indicate that some very considerable modifications will have to be made on the hydrography of this region as it is shown on the best existing maps of East Africa. During the present visit to Africa, Mr. M'Millan intends to devote himself especially to the exploration of the upper and middle course of the Omo River, the great stream which flows into the northern end of Lake Rudolf. Several explorers in recent years, including Dr. Donaldson Smith, Mr. Cavendish, Colonel MacDonald, Majors Bright and Austin,

have crossed the Omo near where it enters Lake Rudolf, and some have followed its course for a certain distance upstream. But, while its upper course is also fairly well known, there is a very long intermediate stretch which remains to be explored, and it is this task which Mr. M'Millan and his companions hope to be able to accomplish.

The Benue-Logone Route to Lake Chad.—According to a note in *Petermann's Mitteilungen* (ix. p. 215) further investigations have been made by Colonel Gouraud on the practicability of this route (cf. this *Magazine*, xx. p. 306 *et seq.*). Colonel Gouraud confirms Captain Lenfant's observations, but finds that the nature of the communication between the Benue and Logone by means of the Mayo-Kebbi and the Tuburi swamp varies much according to the amount of atmospheric precipitation. If the rainy season brings little rain, the passage has many difficulties. In January 1906 Colonel Gouraud is to make an attempt to establish a regular transport service over the stretch of 30 kilometres at the falls of the Mayo-Kebbi where porterage is necessary, and thus facilitate the provisioning of the French posts in the Chad region.

The Population of the French Congo.—In *Le Mouvement Géographique* for September 24 the following figures are given as the results of the census in the Cape Lopez region—1725 inhabitants, of whom 24 are Europeans. In the Ogowai region there are 1,275,181 inhabitants, of whom 181 are Europeans.

Major Powell Cotton's Expedition.—According to the latest news Major Cotton has passed from the region of the Upper Nile by the Mahagi-Irumu route to the Great Forest, which he reached at the end of June. At this time he was in the vicinity of the sources of the Aruwimi. Major Cotton's plans will be found detailed on page 653 of vol. xx. of this *Magazine*. His object is chiefly zoological investigation.

Polar.

New Polar Expeditions.—A number of new polar expeditions are being planned at present, some of which have hardly passed beyond the initial stages. The following account is based upon an article by a *Times* correspondent, and upon telegrams and articles which have appeared in the daily press.

A young Danish sailor, **Mr. Einar Mikkelsen**, who took part in Captain Amdrup's voyage of exploration to Greenland and afterwards in the Ziegler-Baldwin Expedition, has now planned an expedition to the regions west of those explored by Sverdrup in the *Fram* during 1898-1902. The region which Mr. Mikkelsen proposes to explore is likely to yield interesting results, of either a negative or a positive character. A glance at the map will show that between Prince Patrick Island and Banks Land, the most westerly of the islands which form the Parry Archipelago, off the north coast of America, and the New

Siberian Islands, off the coast of Siberia, there is a stretch of some thousand miles which is blank so far as any indication of land is concerned. This region has never been explored; and the object of Mr. Mikkelsen's expedition is, with the help of an American geologist (Mr. Leffingwell) and a Danish naturalist (Mr. Ditlevsen), to discover if any islands exist in this long stretch of sea, through the ice in the south-westerly portion of which the *Jeannette* drifted a quarter of a century ago. It will be remembered that at no great distance to the north of Franz Josef Land Dr. Nansen came upon a sea with soundings of 2000 fathoms. The probability is that this deep sea extends over the whole of the North Polar area to within a distance of the land averaging from 50 to 100 miles. Here Nansen came upon the continental shelf, with soundings rarely exceeding 300 fathoms, plunging suddenly down to the great ocean depths. It is conjectured that the stretch of sea referred to probably covers part of this continental shelf; and, if so, it is not unlikely that some islands may shoot up from the comparatively shallow depth. It is mainly to ascertain whether or not this is the case that Mr. Mikkelsen proposes to organise his expedition.

He will make his way down the Mackenzie River, which he hopes to reach some time in July next. Here the party will remain till August, when they expect a whaler from San Francisco with stores and provisions. This whaler will carry the members of the party to Cape Bathurst, where they hope to engage two Eskimos and a pack of dogs. From Cape Bathurst the party will be conveyed to Cape Kellet, the south-westerly point of Banks Land, where winter quarters will be set up. Before the winter sets in, however, an expedition is to be made to Prince Albert Cape, at the north-westerly corner of Banks Land, for the purpose of setting up a depôt. At the close of the winter, probably about the end of February, a start will be made for the depôt on sledges. Mr. Ditlevsen and the Eskimos are, however, only to see the party over the bad ice, and then return, leaving Mr. Mikkelsen and Mr. Leffingwell, with provisions for about ninety days, to continue the journey alone. Their object will be to obtain a general idea of the extent of the land, if land exists here, and then return with a view to making further explorations on another occasion if circumstances are favourable. The return will be made on a whaler, *viâ* Behring Strait. The whole expense of the expedition is expected not to exceed £2000.

Another expedition, conducted by **Mr. Alfred H. Harrison,** is already on its way to investigate the same problem. Mr. Harrison is to establish a base somewhere near the mouth of the Mackenzie river. He is bearing the whole expense of his expedition himself, but has received the loan of some instruments from the Royal Geographical Society, and also some of the equipment of the National Antarctic Expedition.

A third expedition is that contemplated by **Mr. Mylius Erichsen** and Mr. Knud Rasmussen. It will be remembered (cf. this *Magazine*, xxi. p. 47) that these gentlemen took part in a recent expedition to West Greenland. The new expedition in contemplation is much more ambitious, and Mr. Erichsen hopes to solve a geographical problem in

East and North-East Greenland of the first importance, and to make exhaustive observations and collections in ethnology, geology, zoology, and other departments of science; while, as in his former expedition, the artistic element will receive attention. The expedition will probably start in 1906, and full details will be given later.

Other expeditions in prospect are one by Mr. Edgar Wilson to the North Pole in an airship, and one said to be in contemplation by a recently-formed society in Dawson City.

In the same connection it may be noted that at a sitting of the International Economic Congress at Mons, held on September 25, a scheme for international expeditions to the North and South Poles was discussed. The congress unanimously adopted a resolution in favour of the scheme, and it is stated that numerous subscriptions have already been received. It is further announced that the Government of the King of the Belgians will play a great part in the organisation of the expeditions.

Peary's Arctic Expedition.—A telegram from New York, dated September 6, states that the following message has been received from Etah, North Greenland, in regard to Commander Peary's Expedition.

"The *Roosevelt* will leave on August 16 with twenty-three Eskimos and two hundred dogs to establish a base at Cape Sabine, which may be difficult, as the ice, though apparently not heavy, extends from Littlefield Island to Cape Isabella. No ice has been seen south of Littlefield. The natives have plenty of meat and dogs, and they are located deeper in Melville Bay and Inglefield Gulf than they have been for years. All is well."

Nearly a week later Surgeon Schon, of the auxiliary steamer *Erik*, reported that shortly after Commander Peary's departure the ice broke up, and there was much open water visible between Littleton Island and Cape Sabine. Twelve hours later, from a mountain north of Etah, no sign of Peary's steamer could be seen, and two days later she was still invisible from the same point. This is regarded as an indubitable sign that favourable conditions have been met with, of which Commander Peary had taken advantage to push forward immediately as far north as possible.

Peary's plans are detailed in our September issue, p. 502.

The Duke of Orleans Expedition.—This expedition (cf. p. 333) arrived at Ostend in the *Belgica* on September 12 after a very successful journey. The vessel followed the pack-ice the whole way from Spitzbergen to Greenland, the east coast of which was reached towards the end of July to the south of Cape Bismarck. Journeying northwards from this point the party discovered that Cape Bismarck is on a large island, not on the mainland as has been supposed. To the north of the Cape a new part of the coast, called France Land by the party, was discovered, and was found to be fringed by numerous islands, which are separated from the mainland by a narrow sound. The land itself is indented by deep fiords, behind which arises the inland ice, and

in general characters resembles, as was to be expected, the more southerly parts of the same coast. In lat. 77° 36′ a new cape was found, which was named Cape Philippe, and here a landing was effected. Traces of Eskimos' habitations were found at this spot, including a fireplace of flat stones, and a skull of the musk ox. Proceeding further to the north it was found that the pack-ice became so thick that in lat. 78° 16′ it was found necessary to turn. This latitude is more than a degree further to the north than the point reached by Julius Payer in the second German Polar Expedition on April 15, 1870, and the result of the expedition is thus to diminish the stretch of unexplored territory between Cape Bismarck and Independence Bay. In illustration of this point reference should be made to the map accompanying Commander Peary's last paper (see vol. xix. p. 617). The stretch of coast-land between the two points named which still remains to be investigated is now limited to 3½ degrees of latitude, and even within this area, as indicated on the map, appearances of land were described in the eighteenth century, which enable a hypothetical coastline to be drawn.

The *Belgica* Expedition has, it is stated, brought home large scientific collections, and owing to the fine weather experienced was able to carry on oceanographical research at no less than sixty different points, with the result that a large amount of new material has been collected. The soundings appear to confirm the suggestion based upon those made by the *Fram* that there is a submarine ridge between Spitzbergen and Greenland.

Scotia Bay Meteorological Station.—The Argentine Government have decided to keep on this station for still another year, and have appointed Mr. Angus Rankin, late of the Ben Nevis Observatory, to take charge. Mr. Rankin left Edinburgh for the South on October 11, and was accompanied by two other former members of the Ben Nevis staff, Mr. R. H. MacDougall and Mr. William Bee.

General.

Oxford School of Geography.—We have received the following intimation in regard to the arrangements at this School for the Michaelmas term:—

The Reader in Geography (Dr. A. J. Herbertson) will lecture: (1) weekly on "The British Isles," and commenced on Wednesday, October 18; each lecture will be followed by a map demonstration; (2) twice weekly on "The Regional Geography of the Southern Continents; that of South Africa in greater detail"—this course commenced Thursday, October 19; and (3) weekly on "Types of Land Forms." The Reader will give practical instruction in Regional Geography and in Geomorphology. He will also conduct field excursions, and will give informal instruction to students who are preparing for the Geographical Diploma or Certificate or for other University Examinations in Geography. The Lecturer in Ancient Geography (Dr. Grundy) will lecture weekly on "The Geography of Herodotus." He will also read with students who select Ancient Geography as a

Special Subject. The Lecturer in the History of Geography (Mr. Beazley) will read with students who select the History of Geography as a Special Subject. Mr. J. L. Myers will lecture weekly (for the Reader) on the "Geographical Distribution of Man." The Instructor in Surveying (Mr. N. F. Mackenzie) will conduct a class on "Topographical Surveying." He will also give more advanced instruction in surveying at hours to be arranged. Special arrangements will be made for students taking Climatology and Oceanography, or Geomorphology or Historical Geography.

We are also informed that the Geographical Scholarship, open to any honours graduate of the University, has this year been awarded to R. H. Felton, B.A., of Keble College. The scholar has to study at the School of Geography for a year, and to pass the examination for the Diploma at the end of it.

Dr. A. J. Herbertson also informs us that during the past year branches of the Geographical Association for the advancement of better methods of teaching geography, have been started at Bradford, Bournemouth, and Cape Town.

Edinburgh Outlook Tower.—We have received a syllabus of courses of lectures to be delivered at the Outlook Tower during the current winter under the auspices of the Edinburgh School of Sociology. Some of these courses have a direct bearing upon geography. Application should be made to the Secretaries at the Tower.

Meteorology and Glaciation.—The International Meteorological Conference, arranged for at the Southport Meeting of the British Association, met at Innsbrück on September 9. Dr. J. Hahn was elected Honorary President, and delivered an address, from which we extract the following paragraphs on the question whether there is now going on a general retreat of glaciers in both hemispheres. Dr. Hahn said :—

"Among the results of recent researches no other has made so great an impression upon me as the observations of the British Antarctic Expedition on the retrograde motion of the glaciers now going on in those regions. The renowned great ice barrier of James Ross has receded thirty miles; the glaciers of Victoria Land are in full retreat, and no longer reach the sea; while, on the other hand, the Arctic glaciers are receding, and travellers report the same thing about the snow-covered mountains of Ecuador and South Africa.

"Comparing these facts with reports and observations of the progressive desiccation of Africa and Central Asia, we are confronted with one of the greatest problems in terrestrial physics. This appears the more difficult of solution since we have similar phenomena on a smaller scale which we can closely observe both as regards geographical and time distribution, but are unable to explain from a meteorological point of view. I refer to the continual retrograde motion of the glaciers of the Alps, which you have the opportunity of seeing in the vicinity of the place of our present meeting. Although this phenomenon is proceeding in a district where one may suppose sufficient meteorological observations, both as to time and space, are available, we are still unable

to determine with certainty a direct connection between the variations or periods of the meteorological elements and the movements of the glaciers."

Commercial Geography.

The Vegetable Fibres of the Philippine Islands.—In the *Popular Science Monthly* for July, Mr. H. Taylor Edwards gives an interesting account of the better-known vegetable fibres of the Philippine Islands. The islands are excessively rich in useful fibres, and it is expected that, with improvements of methods and the introduction of machinery, there will be a rapid development of the fibre industry. At present there are only two fibres which are exported from the islands, these being manila hemp and maguey. Of the two the former far outweighs the latter in importance, for while the export of maguey only amounts to about one thousand tons per annum, manila is the leading article of export, and constitutes two-thirds of the total value of all exported products. The actual figures are that the value of the manila exported represents 21,700,000 dollars out of a total of 33,100,000 dollars, being nearly 66 per cent of the total.

Manila, or manila hemp, is the fibre produced by *Musa textilis*, and is grown for commercial purposes only within the islands, which thus supply the world's market. The trade has prospered in spite of many disadvantages, for the process of extracting the fibre is very slow and tedious, and is carried out by very primitive methods. What is required is a suitable machine to carry out the work, and as yet this has not been devised.

Maguey is produced by various species of agave, and is apparently destined to rise in importance. It is at present used locally in many of the provinces of the islands, both as cordage and as textile material, and with the recent introduction of improved fibre-extracting machinery the industry is expected to undergo a marked development.

Cotton has been grown on the islands on a small scale for a prolonged period, but there is at present nothing in the islands worthy of the name of a cotton-growing industry, and large imports of cotton and cotton goods take place annually. It is hoped, however, that the industry may be established in the islands.

The fibre of the pine-apple (*Annas sativa*) is greatly valued for its strength and fineness, and is woven into the beautiful piña cloth. Owing to the fineness of the fibre, however, and the extreme slowness of the primitive methods of extraction employed, the price is very high, and the output small. Again, the only hope for a commercial development of the industry lies in the invention of a machine for the extraction of the fibre.

Among the other fibres which are capable of becoming of commercial importance are kapok or tree cotton (*Ceiba pentandra*), Nipa, rattans, and so on. The fibre of the cotton tree is too short and too brittle and elastic to be spun, but it forms a valuable stuffing and filling

material, and a kapok industry is already well developed in Java. The leaves of the Nipa palm are locally in demand for the construction of mats from which houses are constructed, and the leaves can also be employed for the manufacture of hats, mats, sails, and so on. Another palm used in a similar way is the burri or talipot palm (*Corypha umbraculifera*), whose dried leaves are split into narrow strips. The above summary shows that much is to be expected from the application of modern methods to the fibre industries of the Philippines.

Trans-Pyrenean Railways.—As has already been explained here (cf. vol. xx. p. 659), an arrangement was come to last year between the French and Spanish Governments for the projection of three new lines of railway across the Pyrenees, in order to connect existing lines and to tap the districts on both sides of the great mountain range.

It seems, however, that certain experts on either side of the Divide are not convinced of the wisdom of this scheme. They think that the result will not be commensurate with the expense, and that the scheme will not draw the main centres of the two countries much closer.

The *Boletín de la Real Sociedad Geográphica* of Madrid contains an interesting article by M. Manuel Conrotte, which is itself a criticism of a communication to the *Revue de Paris* by M. Bérard. Señor Conrotte's point of view is that what is required is acceleration between Paris and Madrid-Cadiz. It is shown that, while the post between London and Brindisi takes a day and a half, the line between Paris and Cadiz, which might link up France with Morocco and Senegal, takes the best part of three days. The Orleans-Bayonne part of the line leaves little to be desired, but after that the case is far otherwise. The existing line by Irun, Burgos, etc., to Madrid is, from the point of acceleration, an absurdity. It is suggested that a return should be made to the original scheme of Castro, which was, starting from Bayonne, to take more or less of a bee-line and pass through Pampeluna and Tudela to Soria, and so by Alcuneza to Madrid. Señor Conrotte holds that this would save 187 kilometres. Again, from Cadiz, by abandoning the Córdoba-Alcázar line, and cutting over by Puertollano to the Badajos-Madrid line, a saving of another 100 kilometres could be effected, nearly 300 kilometres in all between Bayonne and Cadiz. Señor Conrotte foresees a time when Cadiz, at present a decadent port, will be the point of call between Europe and Central America with all the possibilities of the Panama Canal in prospect; and, moreover, looks forward to the period when there will be a complete railway system through South America, when a line between Pernambuco and Cadiz will be the natural link. All this may be in the region of mercantile romance, but the countrymen of Cecil Rhodes should not be those to say so.

So far for the west side of Spain; but it is also suggested that the communication between Marseilles and Algiers is none of the best, both from the point of time and from the growing tendency of the Marseillaise to upset the traffic by inconvenient strikes. Here again, by using the port of Cartagena with its four to six hours or so of transit, and the day's journey by train to the French frontier, a considerable saving of

time could be effected. We are assured that the Cartagenese do not indulge in the diversion of strikes!

Thus it is suggested that, in place of the projected trans-Pyrenean lines, it would be more to Spain's advantage to have, on the one side, a greatly accelerated service between Paris and Cadiz; and, on the other, a well-organised service connecting France with her possessions of Tunis and Algeria.

While we can express no opinion on the engineering difficulties, always great in Spain, nor on the financial aspect, we recommend all who are interested in the subject to study with the map both this article and that by M. Bérard, which takes the French view of the question.

NEW BOOKS.

EUROPE.

La Picardie et les Régions voisines: Artois-Cambrésis Beauvaisis. By Albert Demangeon, Doctor of Letters, and Lecturer on Geography to the University of Lille. One vol., large octavo. Paris: Armand Colin, 1905. Illustrations and Maps. Pp. 496. *Price* 12 *fr.*

There are few men who would be able to treat of such a subject without being dull, and it would be hard to blame M. Demangeon for not being among the few. But though heavy, his writing is clear and intelligible, and he has aided the reader with excellent plates and diagrams. He describes his province with great minuteness from every geographical point of view, except the towns. He tells us of the soil and the strata below it, and how they were formed. He describes the course of the rivers and the outlines of the coast, and explains how they came to be as they are. In his exhaustive account of the agricultural, industrial, and commercial condition of the country, he traces each down to its historical source with the greatest erudition. Altogether, if M. Demangeon cannot be congratulated on having produced a very readable book, he has at least given us a thoroughly trustworthy and exhaustive work of reference for the study of his subject.

The Faroes and Iceland. Studies in Island Life. By Nelson Annandale. With 24 illustrations and an appendix on the Celtic pony. By F. H. A. Marshall, D.Sc. Oxford: At the Clarendon Press, 1905.

Iceland has been very often described from the point of view of the tourist, who too frequently takes very little interest in anything beyond the more striking features of the landscape. The above work is welcome as an intelligent contribution to the study of two communities whose isolation for so many centuries lends a particular interest to the consideration of their manners and customs.

The author is evidently a man of very considerable powers of observation, and it is impossible not to be frequently struck by the minuteness and shrewdness of his remarks. In almost all that he has observed for himself his descriptions are admirable, but there is occasionally a want of precision when he deals with what depends upon the reports of others. One may instance the story of the later Icelandic settlers following their drifting house pillars right round to the north coast (p. 174), which would certainly have entailed very slow voyaging; the reference to the Danish "conquest" of Norway (p. 5), a term which would hardly

be recognised, in that country at least, as conveying a very correct idea of a union of the crowns by marriage; the allegation that in Faroe fog is more frequent in summer than rain, and that thunder-storms never occur at that season (p. 19); and the somewhat extraordinary statement (p. 18) as to the reluctance of the women of these islands to so much as exchange a "Good-day" with any man not a relation.

No exception can be taken to the encomiums passed upon the character of the Faroese people; but it may be remarked that the sense of humour to which the author refers is not inconsistent with a strain of melancholy, and a further acquaintance with the people would perhaps modify his views upon this point.

In one respect the author's criticism, usually apt, if occasionally severe, must really be protested against. If the roofing of their houses with turf is an evidence of the intense conservatism of the Faroese people, then His Britannic Majesty's consul must come under the same condemnation, since his comfortable new house in Thorshavn is likewise so roofed. As a matter of fact, a turf roof is very well adapted to the climate.

With reference to another somewhat hasty conclusion (p. 30), it may be pointed out that the use of the word "piece," *i.e.* "stykke," in the sense referred to is quite common in Danish, and it is not necessary to call in the jargon of the China Seas to explain it.

On p. 205 there is a description of the preparation of corn for threshing. The English translation of this passage of Landt's book is not very good, and it is rendered here even less clear by inaccuracy in the transcription.

We have indicated a few points to which exception may be taken. But the book on the whole is an excellent one, and will be perused with interest and with instruction, both by the anthropologist and by the general reader.

The illustrations, which are from photographs, are very good, and we are glad to see that the book is provided with an index. The bibliography is useful but not complete: thus there is no reference to Berg's "Bidrag til Kundskab om Færöerne," which we should have expected to see mentioned, if only for the sake of his craniological and other anthropometric observations. Brunn's paper entitled "Fra det færöske Bygder" (*Tidskr. f. Landökonomi*, 1904) might also have been mentioned, as it gives an accurate account of present agricultural and pastoral conditions in the islands.

Das Europäische Russland: Eine Studie zur Geographie des Menschen. Von Alfred Hettner (Heidelberg). Mit 21 Text-Karten. Leipzig und Berlin: B. G. Teubner, 1905. Pp. 221.

The author states that this work originated in 1897 when he attended the International Geological Congress held at St. Petersburg, and had the opportunity of visiting various parts of Russia. His aim in the present volume is to look at Russia from a geographical point of view, and to ascertain the true character of the Russian people, government, and culture, and thus, without either praise or blame, to arrive at a proper appreciation of Russia. He discusses the nature of the country, its historical evolution and the results, its peoples, its religions, its government, its settlement and population, its commerce, and then the national character, and material and intellectual culture of the Russian people. As all eyes are fixed on Russia at present, and great changes there are awaited, such a work as this by a scientific and impartial observer is very welcome. We may remark that he characterises Sir D. M. Wallace's *Russia* as one of the best works on Russia, but cites the first edition of 1877 and not the revised and enlarged

one of the present year (fully reviewed in this *Magazine* for September 1905). Herr Hettner, in his observations on the future of Russia, recognises the splendid external appearance of the Russian empire, but points out, beneath the surface, the low intellectual level of the masses, and the subjection and spiritual bondage of the whole population. External greatness and splendour have been purchased at the cost of the happiness and prosperity of the people. Greatness and splendour cannot give the security afforded by intellectual culture and a sense of freedom. We may be deceived for long by appearances, but a sudden blow may shatter the rotten structure. The Nationalists' belief in the greater strength of the old Russian people compared with the culture of Europe will be disproved by results. A veneer of European culture over mediæval or oriental customs will not last. Russia can win the great future of which she dreams only by a complete internal change. No one who believes in progress in human history can doubt that that change will take place. The greatness of Russia, and the internal strength slumbering within this northern race, makes it certain that this change will be produced by no alteration of the population but by means of the Russian people itself. Two paths are open, Reform and Revolution. Without an alleviation of its material misery the people, as yet standing aloof from the Liberals' struggles, will gradually listen to their whispered suggestions. May the future save us from a revolution of the Russian people!

Memoirs of the Geological Survey Scotland: *The Geology of the Country round Blair Atholl, Pitlochry and Aberfeldy* (Explanation of sheet 55). By G. Barrow, F.G.S., J. S. Grant Wilson, and G. H. Cunningham Craig, B.A.; with Petrological Chapter and Notes by J. S. Flett, M.A., D.Sc., M.B., C.M. Glasgow: Printed for His Majesty's Stationery Office, 1903. Pp. vi + 161. *Price* 3*s*.

This memoir deals with a mountainous area of 432 square miles entirely within the county of Perth. The rocks described are all crystalline in character and consist of metamorphic schists, grits, limestones, quartzites and gneisses, with igneous intrusions of granite, basalt, and other basic materials. The geological investigation of this area has occupied more than twenty years, and the memoir represents a vast amount of physical and mental labour on the part of the different geologists who have during these years recorded the results, now for the first time made public. A large part of the memoir is of a technical nature, interesting chiefly to geologists or petrographers, and there is not much of economic value to be described as occurring in this ground. The notes on the development of the river system and the origin of the valleys give, however, a geographic interest to this somewhat abstruse work, and it is pleasing to note that a few paragraphs are devoted to the agricultural and sylvicultural characters of the district. Such detailed accounts of regions that without a national survey would probably never be systematically searched are of great permanent value, and their appearance, although often sadly belated, must always be welcomed as standard works of reference, that show what is or what is not to be looked for among the rocks of the area to which they refer.

Dänemarks Natur und Volk. Eine Geographische Monagraphie von Dr. E. Löffler, Professor d. Geographie a. d. Univ. in Kopenhagen. Mit 39 Illustrationen und Karten. Kopenhagen: Lehmann u. Stages Verlag, 1905. Pp. 118.

This pamphlet contains not only an account of Denmark proper, but also of the Faroes and Iceland, and gives at the end a useful little list of references to papers,

etc., on all three regions. As the author points out in his preface, all have hitherto been very inadequately known, largely because, as he states, the Danish language, in which most of the existing publications have been written, is little known in either England or Germany, and hardly at all among the Romance-speaking nations of Europe. The author's object has therefore been to show that the little land of Denmark has both variety and beauty of its own. The volume is certainly one of great interest, and sets forth in concise form the main facts as regards physical conditions, including geology, botany, and zoology, and also as regards the inhabitants of the three areas studied. It is illustrated by sketch maps and by numerous figures, some of which are very good. As the author points out, the people of Denmark, Norway, and Sweden are in origin, language, culture, and history closely allied, and yet in physical conformation the Scandinavian peninsula is very different from Denmark, and in consequence it is an interesting geographical problem to trace the effects of different environment on peoples of the same stock. The inhabitants of Denmark are therefore treated from the historical point of view, and the great modern development of agriculture in the region discussed in detail.

We can cordially recommend the volume as giving an interesting account of the countries named.

ASIA.

A Geographical Account of the Countries round the Bay of Bengal. By Thomas Bowrey. Edited by Lieutenant-Colonel Sir Richard Carnac Temple, Bart., C.I.E. Cambridge: Printed for the Hakluyt Society, 1905.

The latest publication of the Hakluyt Society contains a *Geographical Account of the Countries round the Bay of Bengal* by Thomas Bowrey. It has been carefully and exhaustively edited by Colonel Sir Richard Temple, who very justly remarks in the preface that the value of the work consists in this, that it "fills up a gap in the early history of the doings of the English in Bengal, Madras, and the Malay Archipelago" for the period between 1669 and 1679. Colonel Temple has also contributed an interesting and useful introduction, in which he states what he has been able to ascertain of the personal history and works of Bowrey; and it is very evident from this introduction that the work of investigation, involving as it did prolonged and minute research in the records of the India Office, the British Museum, etc., entailed on him no ordinary amount of patience and labour. The manuscript is the property of Mr. Eliot Howard, of Ardmore in Essex, and "is clearly and carefully written in the handwriting of the period, and has been exceptionally well preserved, so that there is no doubt as to the reading of any part of it. The writer, who was a sailor, further illustrated his MS. profusely with pen-and-ink drawings, such as are common for the period. But crude as many of them are, his representations of ships and boats are not only valuable for the details they give, but also for their accuracy. The whole of the drawings have been exactly represented in the plates attached to the text, on a reduced scale." Thomas Bowrey was a sailor who spent nineteen years in the East, and was undoubtedly "a well-educated man for his time, an acute observer of all that went on around him, and deeply interested in the natives of the country." Some of his observations are of exceptional value. Colonel Temple draws attention to several of them, among which we may notice "his 'Janselone' section, a unique contribution to the history of an island about which there is hardly any record in the seventeenth century; and his references to many notable Anglo-Indians of his day are of additional interest as showing these men in their ordinary daily life, rather than in their official character as they appear in the Company's records, especially as he

writes without the ill-feeling and petty spitefulness common in his day and among the community with which he worked and associated." A perusal of the two sections of the introduction, discussing the authorship of the manuscript and what can be ascertained about the personal life of Bowrey, will not fail to impress the reader with a good idea of the patience and labour already referred to as entailed in the work of editing. The work of identifying the Thomas Bowrey who wrote the *Dictionary of the English and Malayo* with T. B., the writer of this manuscript, required the labour of two years, in the course of which Colonel Temple was twice on the track of wrong men. Of course the events of Bowrey's life, though possessing a certain interest, are immaterial so far as the value and interest of his work are concerned. The real value of the manuscript lies in the corroboration it gives of what we know from other sources of the tracts round the Bay of Bengal during the period to which the manuscript refers, and the additional information it contains regarding men, manners, and places in these days. Colonel Temple has discharged his duties as editor both conscientiously and exhaustively. His notes are very complete, and he invariably gives his authorities. The index also is satisfactory.

AFRICA.

Coins d'Egypte Ignorés. Par ALBERT GAYET. Paris: Plon-Nourrit et Cie., 1905. *Prix* 3 *fr.* 50.

M. Gayet has written a book of singular interest, and one that shows that he is imbued with the spirit and atmosphere of those solitudes about which he writes.

In the preface he expresses a fear lest he has been too abstract, and that the sensations which he has experienced were too vague and indefinite to be understandable by those who have not lived among those unknown places. It is, however, the chief attraction of the book that the author gives one something more than intelligent description, and that he can reconstruct so successfully the far-away past for the benefit of his readers. The preface itself contains many acute reflections on the differences between the races which have contended so often in Egypt and the causes which led to these struggles.

The book is divided into two parts, both dealing mainly with the Egypt of early Christian and mediæval times. The first and larger part is entitled "les demeures des anchorites," - those hermits of the deserts, legendary figures which have come down to us from the introduction of Christianity into Egypt after its conquest by the Romans. Founded first in Alexandria, that home of so many schools of thought, monasticism spread rapidly during the reign of Constantine, and settlements were established not only in the neighbourhood of Thebes, but in large number in Higher Egypt. Of all the old ecclesiastics of Egypt, the name of Schenoudi stands out as one of the best known, and it is on this extraordinary, if somewhat legendary, monk and on his convent at Anthribis that M. Gayet writes in his first chapter. As recorded, Schenoudi's life was a constant succession of miracles, many of them bearing a suspicious resemblance to those recorded of the early prophets. His convent was built as the result of a direct vision, the foundations being laid by divine agents, and the whole work completed in an impossibly short time. The extent to which violence entered into the lives of the monks of Thebes is startling to modern ideas. To burn, to pillage, and to murder were not only justifiable, but praiseworthy if by any means paganism could be exterminated.

Other chapters in this part of the book deal with Antinoe, the monastery of

St. Macaire, the convent of St. Simeon at Assuan, and the monk Moise. And of all of these M. Gayet has much to say of interest.

The second part of the book is entitled "L'Itinéraire des Croisades." Although not in the direct route of the Crusades, Egypt was the scene of important military and naval operations. Damietta was thrice besieged, and Mansurah is famous not only as a battlefield, but as a witness of the captivity of King Louis. M. Gayet is not less successful in this part of the book in sustaining the reader's interest and sympathy in the pictures which he reconstructs.

Acknowledgment is made of the courtesy shown to the author at all times by the British official,—as in Scotland we should insist on translating the expression "fonctionnaire anglais."

AMERICA.

La Repubblica Argentina. Ezio Colombo, Bibliotecario a Buenos Aires. Milano: Ulrico Hoepli, 1905. *Price L.* 3.50.

Considering the large stake which the Italians have in the fortunes of the Argentine Republic, it is most appropriate that this new volume of the well-known *Manuali Hoepli* should be devoted to a study of that country. The author has done his work admirably in a very compact little volume. He begins with a historical sketch of the country, and then proceeds to consider its various general aspects, administration, commerce, products, flora and fauna, art and literature, orography and hydrography, concluding with a more detailed study of the leading features of each separate province. There is a general political map at the end of the volume, but for adequate illustration some physical and statistical sketch-maps would have been of great value.

GENERAL.

Allgemeine und Spezielle Wirthschaftsgeographie. Von Dr. Ernst Friedrich, Privatdozent an der Universität, Leipzig. Leipzig: G. J. Göschen'sche Verlagshandlung, 1904. Pp. 370. *Price M.* 680; *bound M.* 8.20.

There is no strikingly new treatment of the subject in this work, but the information concerning the distribution of articles of commerce is very full and has been compiled with great care. Considerable space is devoted to economic stages of mankind and their distribution. Dr. Friedrich reckons four stages: (1) the purely animal stage, where man uses only his natural physical powers; (2) the stage of instinct, where he makes improved implements to assist him in obtaining the products of nature; (3) the stage of tradition; and (4) the modern scientific stage. These divisions seem to us hardly happily chosen, and the author himself is doubtful whether to assign the Eskimo to the first or second. The hunting, pastoral, agricultural, and industrial stages are better marked, both as regards man and the exploitation of the land, though they too, of course, overlap.

Notes d'Analyse Géographique, conditions qui déterminent la valeur économique d'un pays. Par Emile Chaix, Professeur de Géographie à l'École supérieure de Commerce, etc. Genève: Philippe Dürr. Dated 1906. Pp. vi + 48, with blank pages.

This is a really admirable little note-book, constructed upon what so far as we are aware is an entirely new plan. Its object is to diminish the amount of memory work in the teaching of commercial geography, and at the same time to give students a genuine grasp of the causes which determine the economical development of a country. The author considers successively the various geographical factors, as situation, relief, climate, which is treated with considerable

detail, the products of the different zones of the earth's surface, and so on, and then shows how the book is intended to be used by a summary treatment of the conditions in selected localities, according to his own method of analysis. The method being novel, and the statements made being brief and generalised, there is naturally scope for criticism, but this is somewhat disarmed by the author's frank admission of the fact in his preface. The statements to which we see most reason to object are those that coal is only to be looked for in primary rocks—an error against which every geological student is surely warned—and the unqualified statement that a sandy soil is "mauvaise." Most agriculturists would surely say on the contrary that such a soil is often highly amenable to scientific treatment. These are, however, trifles compared with the general excellence of method, for the author has contrived to entirely avoid the dryness of style into which compilers of such summaries so often fall. There is indeed much in the pamphlet to arouse interest and to give food for thought. For example, under the heading of industry we have in a few short paragraphs a most suggestive outline of the evolution of industry, each paragraph of which in the hands of a skilled teacher might be made the starting point of a series of most interesting exercises for the student, and this even although we are inclined to think that the author here also shows a tendency to generalise from local conditions. In this country at least the statement that "chemical industries establish themselves near water power" is hardly correct.

There is, however, so much to stimulate discussion in the book that we must limit ourselves to one other quotation, a delightful little phrase which occurs under the heading of Peoples and Institutions, and asserts that administrative honesty "est moins répandue qu'on ne le pense." We hope that these Notes will soon be translated, and so made available for English teachers and students.

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st July 1905:—Six-inch Maps (Revised), full sheets, engraved, without contours. *Ross and Cromarty.*—Sheets 24, 36, 38, 46, 50, 51, 58, 59, 63, 68, 69, 73, 80, 85, 91, 94, 96, 112, 113, 119, 120, 132—Price 2s. 6d. each. Sheets 6A, 12, 12A, 80A, 91A, 108 (109A and 115), (133 and 130)—Price 2s. each.

Quarter Sheets, Heliozincographed, with Contours. Price 1s. each. *Banffshire.*—8 NW. Without contours. *Elginshire.*—21 SE.

1·2500 Scale Maps (Revised), with Houses ruled, and with Areas. Price 3s. each. *Elginshire.*—Sheets II. 8, 10, 12; III. 5, 9; VIII. 2, 3; XXIII. 7, 10, 13, 14; XXVI. 4. *Inverness-shire.*—Sheets I. 2; V. 2, 5, 9. *Sutherland.*—Sheet XVI. 16.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st August 1905:—One-inch and smaller Scale Maps. Map of the United Kingdom, on the 1 : 1,000,000 scale or about 16 miles to 1-inch. Mounted as a wall map and bound with ribbon, Price 10s. Ditto, with moulding and roller, Price 20s.

One-inch Map of Scotland (third edition, engraved in outline).—Sheets 2, 9, 13. Price 1s. 6d. each.

Six-inch and larger Scale Maps. Six-inch Maps (Revised), full sheets, engraved, without contours. *Ross and Cromarty.* Sheets 23, 37, 47, 70, 72, 81, 92, 97, 103, 110, 118, 123. Price 2s. 6d. each.—Sheets 1, 1B (2A and 1A), 6. Price 2s. each.

Quarter Sheets, Heliozincographed, with contours (Price 1s. each.) *Banffshire.*—(29 NW. and 29 NE.). *Elginshire.*—8 SE.; 17 SE.

Without Contours. *Elginshire.*—24 NE. (33 NE. and 34 NW.).

1 : 2500 Scale Maps (Revised) with Houses ruled, and with Areas. Price 3s. each. *Elginshire.*—Sheets V. 15; XVI. 2, 3, 5; XX. 4, 8. *Inverness-shire.*—Sheets I. 3, 4, 7, 8, 11, 12, 15, 16; V. 6, 11, 13; XIII. 1, 2. *Nairnshire.*—Sheets I. 9, 10, 11, 14, 15; II. 2, 3, 5, 6, 7, 9, 10; IIA. 15; III. 16; IV. 1, 2, 3, 5, 6, 9; VII. 5.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th September 1905.

One-inch Map (third edition), printed in colours and folded in cover, or flat in Sheets. *Edinburgh.*—Sheet 32. *Haddington.*—Sheet 33, and part of Sheet 41. Price on paper, 1s. 6d.; mounted on linen, 2s. each.

Six-inch and larger Scale Maps. Six-inch Maps (Revised), full sheets, engraved, without contours. *Ross and Cromarty.*—Sheets 10, 71, 74, 75, 83, 84, 86, 95, 102, 104, 111, 117. Price 2s. 6d. each.—Sheet 116. Price 2s.

Full Sheets, Heliozincographed, without Contours. *Inverness-shire.*—Sheets 19, 20, 30, 31. Price 2s. 6d. each.

Quarter Sheets, Heliozincographed, with contours (Price 1s. each.) *Banffshire.*—(7 SW. and 13 NW.); 13 SE.; 14 NW., 14 SW.; 19 NE., 19 SW.; 24 SE. *Elginshire.*—(9 NW. and 9 NE.), (9 SW. and 9 SE.); 14 NW., 14 SW.; 22 SE.; 26 NW.

Without Contours (Price 1s. each.) *Elginshire.*—25 NW., 25 NE., 25 SW., 25 SE.; 29 NE.; 30 NW.

1 : 2500 Scale Maps (Revised) with Houses ruled, and with areas. Price 3s. each. *Elginshire.*—Sheets VI. 13, 14; X. 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16; XIII. 1, 5, 9, 13; XV. 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15, 16; XVI. 1, 4, 9, 13; XVII. 1, 2, 3, 4; XVIII. 1; XX. 2, 3, 6, 7; XXIII. 11. *Inverness-shire.*—Sheets V. 3, 7,10, 14. Sheet V. 15. Price 1s. 6d. *Nairnshire.*—Sheets I. 12, 13; II. 11, 14, 15, 16; IV. 4, 7, 8, 10, 11, 12, 13, 14, 15, 16; V. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; VI. 4, 8 (11 and 7), 12; VII. 1, 2, 3, 4, 6, 7, 8; VIII. 1, 2, 3, 4, 5, 6, 7, 8.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

ASIA.

ASIA.—Philip's Large Schoolroom Map of. Size 80 × 67 inches. Scale 1 : 6,000,000, or 95 miles to an inch. 1905. Price 18s.

Messrs. George Philip and Son, Ltd., London.

This large and effective wall-map is eminently well adapted for geographical teaching. The physical configuration and relief form the basis of the map, and on that the political features are superimposed.

AFRICA.

GAMBIA.—General Staff Map on Scale of 1 : 1,000,000 or about 16 miles to an inch. 1905. Price 1s. net.

Topographical Section, General Staff, London.

MAURITIUS.—Map of the Island in six sheets on Scale of 1 : 63,360, or one inch to a mile. Rivers in blue and contour-lines in brown. 1905. Price 1s. 6d. each sheet. *Topographical Section, General Staff, London.*

RHODESIA, NORTH-EAST.—General Staff Map on Scale of 1 : 2,000,000, or about 32 miles to an inch. 1905. Price 2s. net.
Topographical Section, General Staff, London.

AMERICA.

CANADA.—Electoral Divisions in the Provinces of Saskatchewan and Alberta. James White, F.R.G.S., Geographer. 1905.
Department of the Interior, Ottawa.

ARGENTINA.—Atlas de la Provincia de Córdoba por Manuel E. Rio y Luis Achaval. Scale 1 : 1,000,000. 12 plates. 1905. *Publicacion oficial.*

This atlas effectively illustrates all the geographical aspects of the province. The general political map is followed by hypsometrical, hydrographical, geological, botanical, agricultural and commercial maps. There are also illustrations of town and country scenery, characteristic plants, etc.

SPECIAL CHARTS.

CABLE MAP OF THE WORLD, on Mercator's projection, showing telegraph cables according to different nationalities, revised and corrected to July 1905.
General Staff, War Office, London.

TIDAL STREAMS for the whole of the British Coasts, Ireland, and North Sea for each hour of the tide at Dover, compiled with, and proved by, other authorities, British, French, and German, by an Experienced Pilot. 1905 *Price 5s. net.* *James Brown and Son, Nautical Publishers, Glasgow.*

This most useful work for navigators, in a series of twelve charts, shows the direction of the tidal current on the shores of the British Isles and in the North Sea for each hour of the tide. There are also supplementary charts for the Pentland Firth. Each chart is accompanied by text giving special details and warnings for the guidance of navigators.

AGRICULTURE AND STOCK-FARMING IN SCHLESWIG-HOLSTEIN. Bodenbau und Viehstand in Schleswig-Holstein nach den Ergebnissen der amtlichen Statistik. Im Auflage des Vorstandes der Landwirtschaftskammer für der Provinz Schleswig-Holstein dargestellt von Th. K. Engelbrecht. Atlas bestehend aus 36 Tafeln nebst 144 Nebenkarten. 1905.
Verlag der Landwirtschaftskammer, Kiel.

This atlas is a very fine example of statistical cartography, and well deserves the consideration of our Board of Agriculture as an ideal to be attained in this country. It maps the quality of arable land, and all the various crops ; also the pastoral land, and the distribution of cattle, sheep, horses, pigs, poultry, and other stock with all the precision of a census.

TRACK CHART OF THE WORLD, showing Currents, Ice, Fog, etc., compiled by Captain James Tait, Nautical Academy, Glasgow, 1905.
James Brown and Son, Nautical Publishers, Glasgow.

This is a chart prepared for the use of ships' officers or passengers in mapping the course of the voyage.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

Everyday Life among the Head-Hunters; and other Experiences from East to West. By Dorothy Cator. Cr. 8vo. Pp. xiv + 212. *Price* 5*s. net.* London : Longmans, Green and Co., 1905.

John Chinaman at Home: Sketches of Men, Manners, and Things in China. By the Rev. E. J. Hardy, M.A. Demy 8vo. Pp. xxii + 332. *Price* 10*s.*6*d. net.* London : T. Fisher Unwin, 1905.

The Age of the Earth, and other Geological Studies. By W. J. Sollas, D.Sc., LL.D., F.R.S. Demy 8vo. Pp. xvi + 328. *Price* 10*s.* 6*d. net.* London : T. Fisher Unwin, 1905.

The Central Tian-Shan Mountains, 1902-1903. By Dr. Gottfried Merzbacher. Published under the authority of the Royal Geographical Society. Demy 8vo. Pp. x + 285. *Price* 12*s. net.* London : John Murray, 1905.

Back to Sunny Seas. By Frank T. Bullen, F.R.G.S. Pp. xiv + 287. Cr. 8vo. *Price* 6*s.* London : Smith, Elder and Co., 1904.

Promenades Lointaines, Sahara, Niger, Tombouctou, Touareg. Par le Lieut. H. Paulhiac. Préface par Hugues le Roux. Pp. xxiv + 497. 8vo. *Prix* 5 *fr.* Paris : Plon Nourrit et Cie., 1905.

The Voyage of the Discovery. By Captain Robert F. Scott, C.V.O., R.N. With 260 full-page and smaller Illustrations by Dr. E. A. Wilson and other members of the Expedition. Photogravure Frontispieces, 12 coloured plates in facsimile from Dr. Wilson's sketches, panoramas and maps. In two volumes. Royal 8vo. Vol. i. pp. ix + 556 ; vol. ii. pp. xii + 508. *Price* 42*s. net.* London : Smith, Elder and Co., 1905.

Great Japan: A Study of National Efficiency. By Alfred Stead. With a Foreword by the Rt. Hon. the Earl of Rosebery, K.G., etc. Demy 8vo. Pp. xvi + 483. *Price* 10*s.* 6*d. net.* London : John Lane, 1905.

The World of To-Day: A Survey of the Lands and Peoples of the Globe as seen in Travel and Commerce. By A. R. Hope Moncrieff. Vol. iii. Large 8vo. Pp. vi + 280. *Price* 8*s. net.* London : Gresham Publishing Co., 1905.

Travels of a Naturalist in Northern Europe: Norway 1871, *Archangel* 1872, *Petchora* 1875. By J. A. Harvie-Brown, F.R.S.E., F.Z.S. 2 vols. Demy 8vo. Pp. xxv + 541. *Price* £3, 3*s. net.* London : T. Fisher Unwin, 1905.

The Geology of South Africa. By F. H. Hatch, Ph.D., M.Inst.C.E., and G. S. Corstorphine, B.Sc., Ph.D. Demy 8vo. Pp. xix + 348. *Price* 21*s. net.* London : Macmillan and Co., 1905.

Also the following Reports :—

Deutsche Meteorologisches Jahrbuch für 1904. Jahrgang xv. Herausgegeben von Prof. Dr. Paul Bergholz. Bremen, 1905.

Annales de Géographie, XIV^e Bibliographie Géographique Annuelle 1904 Publiée sous la direction de Louis Raveneau. Pp. 336. Paris : Armand Colin, 1905.

Administration Report of the Marine Survey of India for the official year 1904-1905. Bombay, 1905.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

GEOGRAPHICAL NOTES ON SOUTH AFRICA SOUTH OF THE LIMPOPO.[1]

By F. S. Watermeyer, Government Land Surveyor.

In order to treat with justice a subject of this magnitude, the author should not only be acquainted with the country he describes, but should be familiar with what I cannot claim to know very much about, viz. :— Geology, Stratigraphy, Mineralogy, Botany, etc. The only excuse I can offer for consenting to contribute this paper is that, in the execution of my profession as a land surveyor, I have, during the last thirty-two years, travelled over and actually surveyed a large portion of the country.

I propose to consider the subject by devoting a few remarks :—

1. To a brief historical sketch of the cartography of South Africa.
2. To tracing the history of its population.
3. To discussing the physical features and climatic phenomena that present themselves, with regard to their influence on the development of the pastoral and agricultural industries of the country.

1. The Cartography of South Africa.

I am indebted to Dr. J. Scott Keltie's book on *The Partition of Africa* for the following list of ancient maps, copies of which can be seen therein :—

One by Herodotus, 450 B.C., showing a sketch of the Mediterranean Sea, including the north coast of Africa, the River Nile, and the south coast of Africa, which is erroneously shown as lying north of the Equator.

[1] A paper read before the South African Meeting of the British Association.

Ptolemy's map, 150 A.D., shows the *terra incognita*—south of the Nile, where the map of Africa widens out, east and west.

Al. Idrisi's map, 1154 A.D., shows the sources of the Nile and a river running north-west, from which it appears that the ancients must have heard of the sources of the Congo, but drew it to join the Niger. Al. Idrisi's map, reproduced from Lelewel's atlas, also shows the east coast of Africa as far as Sofala, and a place called Vak Vak, probably the port of Inhambane.

Martin Behaim's globe, 1492, shows the coast of Africa Zanzibar, and Madagascar.

Diego Ribero in 1529 produced the first map of Africa with an apparently correct outline of the continent.

Pigafetta in 1591 gives a map with wonderful interior rivers and mountains, which do or do not exist.

Jacob van Meurs in 1668 produced a map with imaginative interior such as hills and rivers, etc.

H. Moll in 1710 dedicated a map also with incorrect interior to the Earl of Peterborough.

C. Smith in 1815 published a much more correct map showing the Orange River and streams running south

Mr. H. C. V. Leiblaudt-Kieper, of the Cape Archives, has kindly informed me that there is a map of Africa attached to Joan de Barros' *Voyages of the Portuguese*, which seems to have been commenced in 1419. A larger copy was published in Blane's atlas in about 1662.

The Rev. Mr. Valentyn published a map with his history of the East Indies showing the settlement at the Cape.

In 1626 appeared *The Ancient Gold Fields of South Africa*, describing the Africans, their habits, buildings, etc. The frontispiece sets forth that the work is "newly done into English by J. M. Stuart and published at the charges of G. Humble." The publication contains a map, the margin of which is lined with pictures of the inhabitants of the different parts of the continent and Madagascar.

Captain Gordon, of the Dutch East India Service, in 1777-1779 discovered the Orange River and gave it that name. He compiled a map showing his explorations, a copy of which is still in existence.

In 1797-98 Barrow travelled, and added to his narrative a map which was apparently Gordon's map corrected by his own observations. Other travellers, Lichtenstein, Gordon-Cumming, Dr. Livingstone, Andersson, J. Chapman, 1849 to 1856; R. Moffat, 1867; Carl Mauch, 1865-71; Thomas, 1867; G. Wood, 1868; E. Mohr and A. Hubner, 1869 to 1870; Fred. Elton, 1870; T. Baines, 1862 to 1871; Du Chaillu, 1865; Hahn, 1866; A. A. Anderson, 1875; and Erskine, 1875, attached maps to the accounts of their travels corrected by their own observations. The maps were subsequently revised, and generally maps of Africa were from time to time prepared, more reliable in detail, by several English and German cartographers.

The Rev. A. Merenski, of the Berlin Mission Society, and the late Fred Jeppe, published maps on the Transvaal. The latter more particularly, owing to his unique advantages (as an official in the surveyor-

general's department, Pretoria), revised his publication during the years 1875 to 1877 and 1881.

In 1889 M. G. A. Troye, who had purchased the Jeppe copyright and was similarly situated for improving the map, published another edition. The third edition appeared in 1899 and proved invaluable during the late Boer War.

I have omitted to call attention to the fact that many other missionaries besides Dr. Livingstone contributed largely to the mapping of the different parts of South Africa, such as the Jesuit fathers, Silveria, de Santos, and others, from 1560 to 1750.

The Rev. C. J. Latrobe published a map of the Cape Coast (between St. Helena Bay and the Great Fish River), showing the inland settlements as far as Graaf Reinet. All such maps were, however, constructed from the roughest of observations. Men like Dr. Livingstone (who first corrected the old Portuguese maps), Baines, and others, did indeed find their different latitudes by observations with sextants or theodolites. But obtaining their longitudes was no easy matter. These were generally reduced from the distances travelled, computed from the time taken, and the directions from compass bearings. Chronometers, on account of the jolting of ox-wagons, did not give reliable results. In many cases trocheameters were attached to the wagon wheels to measure the distances travelled, but the results in all cases were unsatisfactory. During the rule of the Dutch East India Company in South Africa, the only class of surveying was done by actual traverses with the old Rymland link chains, by the men practising as surveyors at that time. For small plots their results were not very inaccurate, but when larger tracts had to be defined which required traversing over broken country, attempts were made to survey by compass or rough sextant intersections. Many a tale has been related how points were fixed by intersections of a puff of smoke from a fire at distant points.

With the exception of La Caille's Arc of the Meridian measured in 1752, no scientific work was undertaken at the Cape until Sir Thomas Maclear, the Astronomer-Royal, proceeded to verify this measurement in 1840-48.

In 1859-63 Captain Baily, R.E., triangulated the south-eastern portion of the Cape Colony for the purpose of fixing reference points for the Cape Coast survey conducted for the Admiralty by Captain Skead-May and other officers of H.M. Navy. The map of this coast survey was published in 1867. In about 1860 the Cape Government began to realise the importance of correct land measurements, and examinations were instituted—the passing of which qualified men to practise as Government land surveyors. Large tracts of Government land—in the Cape Colony—which were cut up into leasehold farms, were acquired by purchase from the Government.

During the years 1877-87 the greater part of East Griqualand on the borders of Natal was surveyed. Connected trigonometrical surveys were also made northward from Kimberley through British Bechuanaland, by Messrs. H. van Reenen, E. H. V. Melvill, J. J. Bosman, and Moorrees, all doing their work on up-to-date scientific principles.

Since 1883 Sir David Gill, Astronomer-Royal at the Cape, has been conducting the geodetic survey of the sub-continent, and Colonel Morris has been in charge of the detail operations from that date, completing successfully Natal and Cape Colony; the Transvaal and Orange River Colony are now under his guidance. Some years ago Mr. J. J. Bosman triangulated the 20th Meridian from the Orange River northward, and defined on the ground the boundary between Cape Colony (British Bechuanaland) and German West Africa. After the completion of Colonel Morris's geodetic survey of Cape Colony, the Surveyor-General entrusted the formation of the latest map of that colony to the able hands of Mr. Charles Newman Thomas, chief compiler in the Cape Survey Office. This map was published in 1895.

In 1890 the Transvaal Government authorised the detail survey of the different proclaimed gold-fields, viz.:—The Witwatersrand, Heidelberg, Klerksdorp, Marabastad, and Leydsdorp. This was entrusted to the surveyors E. H. V. Melvill, F. H. Rissik, Devenish, M. C. Vos, Relly, and myself, and formed the nucleus of the general survey of the Transvaal which was commenced in 1891. With the data of these surveys Colonel Jackson, R.E., late Surveyor-General of the Transvaal, was enabled (1901-1903) to compute and publish the degree sheets of his map of the Transvaal. For this purpose the above-mentioned surveys had to be connected, and the results obtained in the compilation proved the reliability of the work. The proposed topographical survey of the Transvaal has been abandoned on account of the expensive nature of the work. A connected survey of Swaziland, however, is now to be undertaken. This will at a future date be joined on to the main triangulation of the country.

The development of the Witwatersrand is such as to have made property very valuable, and the population is so largely on the increase that land is daily being cut up into small allotments, giving constant employment to surveyors and map-making establishments.

Before closing this chapter I must refer to the geological survey of the Cape Colony, conducted in the first instance by Dr. Corstorphine, and latterly by Messrs. Rogers and Schwarz, who are rapidly extending and improving the existing maps on that subject.

The geological survey of the Transvaal is being carried out by Mr. H. Kynaston, director, E. T. Mellor and A. L. Hall, whose report for the year 1903, containing a map of the Pretoria and Middelberg districts, is published.

The report for the year 1904, with a geological map of the country as far as Potgeitersrust, is now in the hands of the printers. I have before me Mr. E. J. Dunn's sketch-map of the geology of South Africa, which was, I believe, attached to his report to the Cape Government about twenty years ago. This was the first map of the kind published for South Africa. Dr. F. H. Hatch has also republished his map of the geology of the Southern Transvaal in 1903. Dr. Molengraaf has attached a map to his *Geology of the Transvaal* published in 1901, which embraces the country as far north as the Blauwbergen and Louis Trichard in the Pietersburg district. A most interesting series of six-

teen maps appear attached to a discussion on the rainfall of South Africa during the ten years 1885-1894, prepared by Alexander Buchan, M.A., LL.D., F.R.S.E., and printed by the Cape Government in 1897. In the report of the Meteorological Commission, which also contains notes by Mr. H. Struben, there is a map attached reconsidering the same subject.

2. The History of the Population of South Africa.

The earliest inhabitants of South Africa were the Bushmen, and the Hottentots or Khoi khoi, living in the fifteenth century and later south of a line running south-east from Walfisch Bay to the sources of the Vaal River, then southward to the mouth of the Umtumvuna on the east coast. North of this line the Bantu and Sotho races were distributed in the fifteenth century.

The Bushmen, who are perhaps of the same race as the Pigmies discovered by Stanley on his route along the Congo, seem to have been driven down by the Hottentots, a race somewhat higher in the scale of civilisation. The Bushmen lived entirely on the fruits of the chase, locusts, white ants, and roots; they kept no flocks or herds, and stole cattle and sheep from their neighbours at every opportunity; their hand was against every man, and every man's hand was against them. They were armed with poisoned arrows and were very crafty, living amongst the bushes and rocks, which effectually hid their swarthy skins from their enemies during daylight. Their sight was keener than that of any other branch of the human race. They clothed themselves entirely with skins, and made their own weapons, such as bows and arrows, but do not appear to have had any knowledge of any other manufactures; they were rough artists in their way, and drawings made by them of the wild animals in caves and other places still exist in different parts of South Africa.

The Hottentots had their flocks and herds, which travelled about with them, as they were a nomadic race; they lived on the milk and flesh of these as well as on the fruits of the chase, but they were not an agricultural people.

The Bushmen have almost completely died out in South Africa; a few are left in what is known as "Bushman-Land" and on both sides of the Zak river, and some on the borders of Western Pondoland in the Isolo District of the Transkei.

The Hottentots, or the branch of that tribe called Koranas, have amalgamated with the other races and spread, as a mixed race, north along the borders of the German territory to the pans called the Mier.

The branch that migrated to East Griqualand, 1860 to 1870, have sold all their farms and intermarried with other races, and are living as servants on land granted them by Government.

In the north of Little Namaqualand, in the Apprentjesberg in the Maclear Districts in East Griqualand, and the Genadendale Mission Station near Caledon in the Cape Colony, a class of Bastards live, who style themselves Apprentjes or Apprentices, *i.e.* what their fathers

became when the slaves were liberated in 1872. These are for the most part bastards of white men and negro women slaves. They are generally of large stature and fine physique.

The Bantu races, on the other hand, were an agricultural as well as a pastoral people, and were considerably higher in the scale of civilisation than the Bushmen and Hottentots; they knew how to extract copper and iron from the ores by blast furnaces. It is very interesting to examine the remains of such furnaces to be found in the old workings, where one still finds the slag from the melted ore, bellows, stone-nozzles, etc. They also knew how to spin cotton thread from the native cotton, and their descendants may still be seen doing the same thing near the junction of the Selati and Olifant's rivers.

The Bantu races never established themselves further to the south and west than the Great Fish River, being driven down by the more powerful tribes from the north.

The Bantu and Sotho tribes speak languages evidently derived from the same source, but these are dialectically very different. The Bantu races occupy the south-east coast of South Africa, and extend northward to the Portuguese territory. They comprise the Amaxosa, the Amatembu, Amapondo, Amabaca, Amazulu, Amatonga, Amatshangana, and Amatabele tribes, speaking the same language with small dialectic differences.

The Sotho race comprise the Batlapin, Batalaro, Barolong, Bahurutsi, Bangwaketsi, Makalanga, and Basuto tribes. They occupied and still occupy for the most part the interior of the country, speaking throughout different dialects of the Sesutu language.

Branches of this tribe speaking languages with greater dialectical differences are the Ovaherero and Ovampo tribes, living in German West Africa, Damaraland, and Ovampoland, towards the west coast.

The Zulu warrior Mosilikatze with his hordes overran the Transvaal and killed off the males of many of the Sotho tribes on his way northward in the third decade of the eighteenth century. His warriors slaughtered the men and captured the women, and we have now in the northern districts of the Transvaal tribes speaking a mixture of the two languages.

The Bantu and Sotho tribes are by no means dying out in South Africa, although diseases of many kinds are rife. The Medical Officer of Health for the Transvaal, in his report for 1904, gave us the total death-rate for the year ending 30th June as 14 per thousand of the white population, and 9 per thousand of the coloured population. In Johannesburg, however, for the year ending June 1904, the percentage of deaths were 17·2 Europeans per thousand, 19·5 Asiatics, and 32 coloured persons, per thousand. As natives working in Johannesburg are principally young adult males, this return seems inconsistent with the death-rate of 9 per thousand above mentioned, and goes to show that a large number of infantile and other deaths among the natives could not have been recorded.

These tribes are now assimilating themselves to European habits in their dress and mode of living, and being now under British control are

no longer allowed to butcher each other from time to time, as was the custom in years gone by.

They possess but a comparatively small proportion of the Transvaal, nearly the whole of Swaziland, a very large portion of Natal and the Transkei, in the form of locations. These locations generally are the pick of the country for agricultural purposes, because the natives were in most cases allowed to retain the lands which they had cultivated for generations.

With regard to the colonisation of South Africa by European races, this commenced when the Netherlands Company took possession of the Cape in 1652. The historical sketch at the end of this paper, written by Henry de Smidt, C.M.G., Assistant Treasurer-General of the Cape, was appended to the census return of 1901, and is copied from the Cape census return, 1904. (See Appendix A.)

In the years 1830 to 1840 the Boers moved from the Cape Colony north through the Orange and Vaal rivers round the Drakenberg Mountains to Natal. They found a few English at Port Natal, but were not allowed to remain in possession of that part of the country for long, as it was shortly thereafter proclaimed a British colony.

There were no statistics for many years, and I have no back numbers of the Natal census returns to make a comparison of its increase.

The preliminary report of the census for 1904 gives the following returns:—

Population.

	Total.	Males.	Females.
Whites or Europeans,	97,109	56,758	40,351
Mixed and others,	6,686	3,610	3,076
Indians and Asiatics,	100,918	63,497	37,421
Natives in service,	79,978	69,746	10,232
Natives in native areas,	824,603	357,020	467,043

Return of Stock.

Cattle,	343,159	Kaffir sheep,	105,144
Horses,	21,851	Goats,	797,259
Woolled sheep,	25,706	Pigs,	50,461

There was no attempt at a census in the Transvaal until April 1890 by the late Government of the Republic, when the following return was made of the white population alone:—

White males,	66,498
White females,	52,630
Total,	119,128

The following return of white inhabitants per square mile was also given for the different districts:—

Bloemhof,	1·173	Potchefstroom,	3·092
Ermelo,	1·155	Pretoria,	2·335
Heidelberg and Witwatersrand,	7·475	Rustenburg,	0·901
Lichtenburg,	0·792	Standerton,	2·060
Lydenburg,	0·527	Utrecht,	1·171
Marico,	1·610	Vryheid,	0·891
Middelburg,	1·205	Wakkerstroom,	1·735
Piet Retief,	0·505	Waterberg,	0·139
		Zoutpansberg,	0·185

The total number of square miles for the whole of the Transvaal was at that time 113,642. The total number of square miles in the Transvaal since Utrecht, Vryheid, and a portion of Wakkerstroom have been annexed to Natal is 111,196, or 71,165,440 acres; of this Government holds 33,619 square miles, or nearly one-third of the area of the country.

By the census of 1904 the white inhabitants of the Transvaal were found to be 299,327; natives, 945,498; other coloured persons, 23,891. Total inhabitants, 1,268,716. The proportion of the sexes is as follows:—

	Males.	Females.
Europeans,	179,723	119,604
Natives,	506,186	439,312
Other coloured races,	16,826	7,065
Totals,	702,735	565,981

I am indebted to Mr. J. R. Russell, Secretary to the Transvaal Census Commission, for an approximate return of the cattle, horses, sheep, goats, and pigs, for the whole Transvaal and Swaziland, exclusive of Pretoria proper and the Witwatersrand census district.

Cattle,	525,184	Other sheep,	432,209
Horses,	39,264	Angora goats,	84,750
Mules,	34,974	Other goats,	841,098
Asses,	31,477	Pigs,	152,363
Woolled sheep,	411,252		

The following is the census return of the Orange River Colony as it appears in the Government Notice No. 199 of 1904:—

The population of the Orange River Colony numbers 385,045, showing an increase since 1890 of 177,542 or 85 per cent. The increase of white population is 65,703 or 84·54 per cent., as compared with 111,839 or 86·17 per cent. in the case of the coloured population. Of the total population 143,419 or 37·25 per cent. are white, and 241,626 or 62·75 per cent. are coloured. That is 168·48 coloured to every 100 white.

The first census of the late Orange Free State was taken on the

31st March 1880, when the population numbered 133,518 persons, of whom 61,022 or 45·7 per cent. were white, and 72,496 or 54·3 per cent. were coloured.

At the census taken on the 1st March 1890 the population was 207,503, an increase of 73,985 or 55·41 per cent. on the total population of 1880. The increase was more marked among the coloured than the whites, being 57,291 or 79·03 per cent. in the case of the former, as compared with 16,694 or 27·36 per cent. for the latter.

Of the total population the whites amounted to 77,716 or 37·45 per cent. The coloured numbered 129,787 or 62·55 per cent. The corresponding percentages for the census of 1880 were 45·70 and 54·30; in other words there were in 1890 167·00 coloured persons to every 100 whites, as compared with 118·80 in 1880.

From the Cape and Transvaal census returns of the Orange River Colony and Natal, the following table showing the population is prepared:—

	European or Whites.	Other than European or Whites.	Total Population.
Cape Colony, . . .	579,741	1,830,063	2,409,804
Transvaal, . . .	299,327	969,389	1,268,716
Natal (unaudited), . .	97,109	1,011,645	1,108,754
Orange River Colony (unaudited),	143,419	241,626	385,045
Basutoland, . . .	895	347,953	348,848
Totals, . .	1,120,491	4,400,676	5,521,167

For the Cape Colony, exclusive of British Bechuanaland, the annual rate of increase of population is:—

	Colony Proper.	Transkei.
	Per cent.	Per cent.
Whites, . . .	32·15	32·00
Bantu tribes, . .	31·18	20·25
Mixed and other races, .	18·53	2·92
Total, . .	28·04	20·30

The increase for thirteen years, 1891-1904, is:—

Whites, . .	51·05 per cent.	An annual increase of 32·23 per cent.
Bantu, . .	38·28 per cent.	An annual increase of 23·24 per cent.
Mixed and other races (coloured)	26·42 per cent.	An annual increase of 18·20 per cent.

I am not in a position to give any statement relating to the number of inhabitants of the Portuguese territory south of the Limpopo, as I have no data to go on. There is a very considerable native population

(Amatchangana) and a small population of Portuguese, except at Delagoa Bay, where there is a considerable population of different nationalities.

3. The Physical Features of South Africa.

A glance at any current map of South Africa will show the Orange River taking its source in the Drakenberg or Quathlamba range of mountains on the western border of Natal, which at the Giant's Castle, Cathkin's Peak and Mont aux Sources, reaches to the height of 10,000 feet or more.

South of the Orange River the Cape Colony is divided by the watershed of this river and the coast streams, that is by the Drakenbergen, Storm Bergen, Zuurberg, Compass Bergen, and the Nieuveldt and Roggeveld mountains, continued through Little Namaqualand as the Vogel Klip mountains. This watershed also divides the country into the two extensive Karoo tablelands of Cape Colony, lying west of the 26th degree of East longitude, which extend some distance north of the Orange River, until the zone of the more or less regular annual thunderstorms is reached, where the grass-covered tablelands of the Orange River Colony and Griqualand West extend northward between the Vaal and Orange rivers.

To the north-west we have the Langeberg and the Kaap Plateau *via* Bechuanaland, which form the watershed of the Molopo, the Hart and Vaal rivers.

The Witwatersrand tableland running eastwards from Malmani through Johannesburg, Bethal and Belfast in the Transvaal, forms the watershed between the Vaal River and the Limpopo or Krokodile and Olifant's rivers, while the same tableland converging on to the Drakenberg, through which the Olifant's River breaks, forms the watershed between the Limpopo and East Coast streams, viz. the Komati, Umvulusi, and Pongolo rivers.

Leaving the theory of the formation of the earth's crust to experts, and considering only what we actually perceive, we find that the tablelands are composed of hills and valleys, on which the process of denudation in the course of ages does not appear so marked as at the intermediate and lower levels, which are deeply intersected by running or dry streams and ravines.

The hills and mountains are formed by granitic, volcanic, and sedimentary rocks, sandstones, conglomerates, slates, clays, etc. etc., and the tableland slopes and high-lying valleys by soil formed either from ancient sedimentary rocks or from later deposits derived from the disintegration of the protruding rocks. Receding from the high-lying tablelands we have intermediate belts composed of lower-lying flat country on which the process of denudation becomes very marked along the slopes of the mountains to the lower levels. The surface soil on the flats also shows in most instances that it is a deposit from the disintegration of the adjacent mountains, while the hill-sides are chiefly composed either of hard rocks or the original beds of the superimposed sedimentary deposits, sand, clay, gravels, etc. The great Karoo plains show great variations in

their deposits; a very large part of the soil is very shallow, covering slate, shale, or sandstone formations, and in the other parts we find mostly in the valleys and along the courses of the streams rich loam deposits. The same may be said of the great High Veld tablelands in the Orange River Colony.

Sand, however, forms a very large part of the surface of South Africa, and the proportions of the richer soil are very small compared to it.

The above is but a general statement. I shall endeavour to define later on where the best soils are situated, when I consider them in conjunction with the climate and water supply.

Unlike many parts of Europe and America, the height of the surrounding country before the streams reach the sea is so great that their waters attain great velocity, and a very large part of the sand and soil carried down by them finds its way to the sea. Notable exceptions are the Zak and Hartebeest rivers, which take their source in the Roggeveld mountains and Karoo Bergen, and after they have joined, run northward into the Orange River.

Alluvial deposits after rains are continually being formed along the banks of these streams by the overflow of the mud-and-sand-laden water from the higher levels, which forms a silt as far down as the rocky barrier called De Naauwte; after that the water does not leave the streams. The same thing occurs along the upper portion of the Magalikwyn river or Nylstroom in the Waterberg district of the Transvaal Colony.

With these exceptions I cannot remember in my travels to have noticed any other part of South Africa where deposits of this nature are being formed to any useful degree.

(I would therefore point out here that, artificially, in certain parts of the colony, among the most progressive farmers, a great deal is, I understand, being done by forming obstructions of wire-netting, etc., thereby damming up the rapid flow of the water in channels over the surface of the country, and allowing the passing silt to be deposited.)

Unfortunately for South Africa, although the land in the interior rises to a height of 5000 or 6000 feet, there are no high mountain ranges to intercept the moisture from the passing clouds, except along the coasts, where the Drakenberg along the east and south-east, the Winterberg, Zuurberg, Winterhoek, Outiniqua, Zwartberg, and Langeberg mountains on the south arrest the moisture from the periodical east and south-east winds—especially the south-east Trade wind from the Indian Ocean during the summer months. The Karree Bergen, Cedar Bergen, Cold Bokk Veld, Hex River, and Zonderrind Berg, intercept the moisture from the western and north-western winds during the winter months, with the result that the coast lands on the east of South Africa are well watered during the spring, summer, and autumn months, and on the east, south-east, and south-west during the winter months.

The Bokke Veld and Rogge Veld Karoo sometimes benefit by the winter rains on the west coast; the streams west and east of these mountains are annually replenished by them.

The western watershed of the Great Fish River forms the western boundary of the South Karoo, which in common with the Karoo covering a portion of the northern and midland provinces of Cape Colony, with Griqualand West, have to depend upon the irregular summer thunderstorms, which do not fall so frequently as in the Transvaal, the northern portion of the Orange River Colony, and British Bechuanaland.

The northern border of the Karoo Bush, which does not extend far north of the Orange River, marks the line of the more or less regular summer thunderstorms, which extend to the 32nd and 33rd degree of South latitude, and sometimes further south. The rainfall in Little Namaqualand, Bushmanland, Frazerberg, and Carnarvon, is considerably less than it is in the districts lying more to the east and north of Cape Colony.

British Bechuanaland, bounded on the north by the Molopo, west by the 20th degree of East longitude, south by the Orange River and Griqualand West, east by the Transvaal Colony, is also watered by the summer thunderstorms, but the portion of it falling in what is known as the Kalahari Desert, west of the Langeberg, is supposed to be waterless. This is not really the case, as this part of the country does get a fair share of the summer thunderstorms which support the mimosa and coarse grasses abounding in these parts, but there is little or no permanent surface water on account of the sandy nature of the soil, which cannot retain the moisture, so that this disappears below the surface except at the pans in the Mier country, on the border of the German territory near Zwart Modder.

I may mention here in passing some peculiar waterholes south-east of the Langeberg, on the western border of Griqualand West, at a place called the Wit Sand, which is a group of sandhills in the flats. These sandhills are formed of well-washed white sand in marked contrast with the surrounding country, which is not very sandy there. The water occurs in permanent pools on the tops of these sandhills, and it suggests itself to me that these sandhills are formed by underground volcanic or other channels conducting the sand-laden water washed down the sides of the Langeberg mountains during the summer months to the surface, where the white sand is constantly being thrown up. It is a peculiar fact that these sandhills seem to offer great attraction to the lightning, as numerous fulgurites are picked up on them by the natives living in the neighbourhood.

The Transvaal and Orange River Colonies have to depend almost entirely on the summer thunderstorms for their annual water-supply.

(*To be continued.*)

THE SOUTH AFRICAN MEETING OF THE BRITISH ASSOCIATION.

1. THE TOUR OF THE ASSOCIATION.

By Professor J. Y. Simpson, D.Sc.

(*With Illustrations.*)

To tell the story of the British Association in South Africa is to furnish an itinerary of nearly twenty thousand miles of wandering, and to furnish *résumés* of numerous papers of first-rate importance, dealing either with local problems of general interest or with the most recent advances in modern science. It is also to recount the lighter side of the most gigantic picnic ever organised, and unstintedly to shower praise on many officials at home and in the colonies who worked unsparingly to make the visit the unqualified success it ultimately proved to be. When one considers what was involved in the transport and provisioning of four hundred men and women, particularly in territory where even the settlers are still feeling their way, it would have been small wonder had there been failures or breaks-down to record. That nothing of any moment occurred is ample proof of the care with which every detail of the Association's progress through the country had been arranged; and if one or two aldermanic individuals have searched for and found grounds of complaint, it is principally due to the fact that they failed to recognise that place and position at British Association enterprises and functions bear no direct relation to a man's waist measurement.

The bulk of the official party landed off the *Saxon* on August 15th, and the same evening the business of the Association commenced. Three days were occupied in this way, after which a dispersal took place, with Durban as the rendezvous. Some went directly there by steamer, visiting Port Elizabeth and East London *en route*; others remained to take advantage of the excursions that had been planned in the neighbourhood of Cape Town; geologists moved off immediately and instinctively in the direction of the Karoo; a few selected the overland route, with its bird's-eye views of Cape Colony, the Orange Colony, a portion of the Transvaal, and Natal.

With regard to Cape Colony, it must be admitted that the region is at present passing through a severe economic crisis. Trade is generally seeking those ports that involve a shorter railroad journey to the dominating Transvaal. The bulk of the country is pastoral, yet, owing to the periodic, often years-long, droughts, farmers have sometimes been compelled to slaughter their lambs because of the insufficiency of food for them and for the sheep. For the same reason agricultural pursuits are hindered beyond a certain point, nor is there any prospect of irrigation on a scale comparable to that in India, simply because there are not the rivers. Locusts descend in clouds, and on the wheat-patch off which the farmer hoped to garner sixty bags, not a blade is left. Owing to rust, only two months' supply is being grown at present in place of a sufficiency for seven months; hence follows the need for importation, but the diffi-

culties of labour and of water are so great that the local farmers cannot compete with the imported grain. Worcester was the centre of viticulture on a large scale, but the Phylloxera has brought the industry into a very parlous condition, and it must be long before the local varieties have everywhere been grafted on to introduced American vines. As for stock diseases, their name is legion.

Much of this is patent even in the rapid view that was necessarily the lot of the British Association member; but, on the other hand, evidence was not far to seek of the success that has attended the Government endeavours to develop portions of the Karoo by boring for water, as at Matjesfontein, 195 miles from Cape Town, on the Western

Fig. 1.—On the Karoo.

Railway system, and Laingsburg, 18 miles further along the same route. Again, systematic campaigns have been planned against the locusts, and by means of spraying with arsenate of soda and other devices, the Agricultural Department, with the willing assistance of the farmers, has done much to reduce this evil, while every day fresh information is being gained as to the best manner of dealing with the various internal and external parasites that are the active causes of the horse and cattle plagues.

The Karoo once gained by way of the beautiful Hex River Pass, gives the impression of a vast waste; mile upon mile of light brown sandy soil, through which at points the bare rock shows, like a skeleton breaking through the tight-drawn mantling skin. And that same soil is little concealed by the very discontinuous growth of heath and shrubs

—mesembryanthemum and euphorbias for the most part, together with *Acacia horrida*. There is nothing to rest the eye; everywhere hard, straight lines even on the summits of the occasional kopjes, and a general feeling as if one were crossing some enormous Highland stony fallow field.

In and around Durban the Association had the opportunity of seeing something of a really British colony, as of the two industries that have done so much to make it commercially successful. Already 4000 acres are under cultivation to tea planters, while the sugar industry antedates the history of the country as a British colony, and is now capable of putting £600,000 worth of produce on the market annually, as also of giving employment to 8000 people. Of these, however, the great majority are

Fig. 2.—Marriage of Zulu Chief, Henley, Natal.

imported Indian coolies, who, together with those employed in other lines of service, now outnumber the 97,000 Europeans, and, being free, constitute something of an Indian peril. For by their industry, sobriety, and economical instincts they practically have all the smaller trade in their hands, while many of their number are rich both in money and in land as the result of business efforts on a grander scale.

On more than one occasion native war-dances were arranged for the entertainment of the visitors, and there are those of the over-sea party whose most vivid impressions were gained on the 25th of August, when at Henley, in the vicinity of Pietermaritzburg, the chiefs and representatives of these large tribes, who number collectively over 18,000 souls, gathered to do honour to the Governor of the colony, and take part in the wedding festivities of one of the chiefs. One of the illustrations

accompanying these notes represents a preliminary stage in the order of procedure, when the agent of the bridegroom, usually a brother or uncle, who has arranged the marriage and the amount of the marriage consideration or obolo, steps forward and, after a speech to the members of the tribe, shows his pleasure by performing a number of antics and evolutions: the bridegroom is seated on the ground in the centre of the circle. Certain customs usually observed at these tribal weddings are interesting, and might even appear to some Western minds worthy of imitation. Thus the visitors were credibly informed "that the mother of the bride, on no account whatever, may be present at the wedding; that if the bride is the eldest daughter of her father, he does not attend at

FIG. 3.—Native hut, Bellairs, Natal.

the wedding; that the bride may not look at the husband's father; that in many tribes the mother-in-law may not look at her son-in-law, nor may the son-in-law look at her." But, added our informant, "these usages vary, and are becoming more or less obsolete with the advance of civilisation."

Several opportunities presented themselves of seeing the native in his home, both in small country kraals and in the larger stadts that lie on the outskirts of most South African towns. It became evident that the native question is *the* South African problem. Each of the four colonies has its specific difficulties, but in every one there is this pressing matter in one form or another. The difficulty is increased by the fact that in each of the colonies the attitude of the white man towards the native differs, varying from the extreme Cape Colony position, where he

is given a vote, to, say, the Transvaal point of view, where he is not even allowed to walk on the pavement. A principal obstacle to the South African Federation is the present impossibility of agreeing on a uniform attitude to be observed towards the native. One thing, however, stands out clearly, and that is the necessity of teaching the Kaffir the dignity of labour, together with some regard not merely for his fellows, but for the land in which he lives.

The hours spent on the Natal battlefields in the course of the Association's progress towards Johannesburg are a source of very potent memories. The bare grave-strewn field of Colenso; the actual position of each of Long's guns marked by a stone only recently removed, as if men wished that the incident should be forgotten; the flat-topped Hlangwane deceiving everybody as it deceived Buller into thinking that it lay on the other side of the Tugela; the Boer trenches with the barbed wire still in place, nay, with the very pebble-filled tins still attached that would have rattled out the advent of the enemy; bullets and fragments of shrapnel lying around—it was all terribly real even after five years. As also Ladysmith, back of the hills, defended by a miracle, and for ever a source of inspiration to every one who regards the flag of his country with affection.

> "Tell England, ye who pass this monument,
> We, who died saving her, rest here content."

Such are the lines on a soldier's tombstone in the Wagon Hill cemetery.

In Johannesburg three days were spent in scientific session, but plenty of times and occasions presented themselves for making cursory examinations of the mining industry, and for inquiring into such a burning question as Chinese labour. There is little doubt that one great benefit of the Association's visit to South Africa lies simply in the fact that a number of intelligent British men and women were enabled to see vexed matters on the spot and obtain information at first-hand, which was bound profoundly to modify any preconceived ideas on such topics as the native question, the education question, and Chinese labour. With regard to the last point, many of us came unhesitatingly to the conclusion that, although an evil, it is yet at this stage a necessary evil. Further, it is the Transvaaler's question, and with him must rest the decision; for it is he who suffers, and it is he who also, whatever may be said to the contrary, will benefit by the presence of the Chinese labourer.

After the Johannesburg sojourn (in connection with which was a delightful visit to Pretoria), the Associationist found little rest for the sole of his foot. The bulk of the party went round by rail by way of Bloemfontein and Kimberley to Bulawayo: a few took the opportunity of seeing the country and the Boer at home by trekking direct to Mafeking. This meant a journey of five days by mule, wagon, or coach, over territory whose characteristic features changed daily, and finally blossomed out as "The Garden of the Transvaal" in the Marico district. Although there is still considerable dissatisfaction and bitterness amongst many

of the Dutch farmers—and that not altogether without reason—yet it is probable that the majority are well disposed if only they are sympathetically and fairly treated. Nothing seemed to be more clear than the wonderful success of Lord Selborne in a most difficult position, and it is sincerely to be hoped that he will be given every opportunity of completing the work which he has so auspiciously begun.

Bulawayo, founded on sentiment, is at the present moment finding in it poor sustenance. It was a Rhodesian idea to plant a town on the site of Lobengula's kraal, and so long as it remained the terminus of the railway, and the mining industry was in its initial stage of unjustifiable inflation, the place "boomed," but a day came when the

FIG. 4.—"Drift" on the road, Marico district, Transvaal.

railway passed beyond the town, since when it has been gradually retrogressing, although it is probable that the backward movement has now reached its limit. And in any case Bulawayo must ever be a place of pilgrimage, for in its vicinity lies the wonderful Matopo country in the middle of which Cecil John Rhodes is buried. The outlook known as the "World's View" is unique; as if one gazed upon the unswept workshop of creation, the place where the earth was fashioned in the days of old—ridge upon ridge of fantastically-shaped granitic masses lying about in strangest confusion.

Our Ultima Thule was the Victoria Falls, where, however, sufficient time was hardly allowed to gain a complete impression of this glory of Nature. Under the circumstances, however, this was perhaps unavoidable, and only served to deepen the intensity of the moments that

were available. The tropical vegetation of the river banks and islands, the clear and placid water above the Falls, the sudden frenzied leap into the mile-broad chasm, the tumult of the waters hidden in the impenetrable barrier of spray and spindrift rising hundreds of feet into the air, the beauties of the gorge, and a hundred other points of appeal—no man may easily reproduce them with pencil or with brush. We retraced our steps to Bulawayo. Thereafter some returned directly by Cape Town, while others, journeying east by Salisbury and Umtali, embarked at Beira. Thence, touching at Mozambique and Mombasa, where time only permitted a short but romantic run up the British East African Railway as far as Mazeras, the eastern detachment of the Association suffered compulsory but not altogether unrewarded delay in the Suez Canal owing to the *Chatham* misadventure, eventually, however, with the loss of three days, reaching that country from which, when any inhabitant sets out, he somehow thinks of the day of his return.

2. GEOGRAPHY AT THE ASSOCIATION.

By The Editor.

The official party of the British Association left Southampton on Saturday, July 29, and arrived at Cape Town after an uneventful journey on August 15. The same evening Professor Darwin delivered the first portion of his presidential address. Professor Darwin began his address with a comparison between Vasco da Gama's voyage and that of the Association, which is of some geographical interest, and may be quoted here. He said :—

"Bartholomew Diaz, the discoverer of the Cape of Storms, spent sixteen months on his voyage, and the little flotilla of Vasco da Gama, sailing from Lisbon on July 8, 1497, only reached the Cape in the middle of November. These bold men, sailing in their puny fishing-smacks to unknown lands, met the perils of the sea and the attacks of savages with equal courage. How great was the danger of such a voyage may be gathered from the fact that less than half the men who sailed with da Gama lived to return to Lisbon. Four hundred and eight years have passed since that voyage, and a ship of thirteen thousand tons has just brought us here, in safety and luxury, in but little more than a fortnight. How striking are the contrasts presented by these events. On the one hand, compare the courage, the endurance, and the persistence of the early navigators with the little that has been demanded of us ; on the other hand, consider how much man's power over the forces of Nature has been augmented during the past four centuries."

On the following day, August 16, the Sections met for the first time. The meetings of Section E were opened by the reading by the President, the late Admiral Sir W. J. L. Wharton, of his presidential address, reprinted in our October issue (p. 513). This was followed by a paper by Colonel Johnston, R.E., of the Ordnance Survey, on the work of the Survey. Colonel Johnston was followed by Mr. L. C. Bernacchi of the *Discovery*, who spoke on the work of the National Antarctic Expedition.

As regards the presidential addresses in the other sections, it is to be noted that several had more or less bearing upon Geography. Thus, in Section D (Zoology), Mr. G. A. Boulenger, in taking the somewhat technical subject of the Distribution of African Freshwater Fishes for his address, laid special emphasis upon the bearing of this subject on the physical geography of Africa in the past. The following quotation may serve to illustrate this point:—"To mention two examples, the fishes of the Nile show so many specific types in common with those of the Senegal-Niger, now more or less completely separated by the Chad Basin, that we felt justified in postulating a recent communication between these water-systems, which has been fully confirmed by the study of the Lake Chad fishes; whilst, on the other hand, the greater difference between the fishes of the Nile and those of the Congo Basin, the waters of which interlock at present in such a way that it is believed possible, at certain seasons, for a man in a boat to pass from one to the other, points to the existence, until very recently, of a more effective separation." In another part of his address, Mr. Boulenger discusses, in an interesting way, the history of the fauna of Lake Tanganyika in relation to the history of the lake itself. In regard to this lake he accepts Professor Cornet's view that it is of geologically recent origin (probably of Miocene age), and that until recently it was a salt lake, without an outlet.

In Section H (Anthropology), Dr. Haddon gave an important address on the peoples of South Africa, in the course of which he gave an account of the Bushmen, the Hottentots, the true negroes, the Bantu races, and the Hamites, with brief notes on some other less important races. Dr. Haddon appealed for a closer study of South African ethnology, and especially of the Kattea, Bushmen, and Hottentots, races apparently doomed to disappear, and still very inadequately known.

In Section G (Engineering), Colonel Sir C. Scott Moncrieff devoted his address to the subject of Irrigation, and much of his paper bore more or less directly upon Geography.

On August 17 a joint meeting of Sections E and C (Geology) was held, the first paper being one by Mr. H. C. Schunke-Hollway on the Physical Geography of Cape Colony. In the absence of Mr. Schunke-Hollway on account of ill-health, the paper was read by Mr. Cornish Bowden. An abstract follows:—

"To describe the physical geography of the Cape Colony in relation to economic facts would be too great an undertaking. The writer therefore proposes merely to add a few notes on economic conditions. The orographical map shown to the meeting is constructed from such data as are available, but is far from perfect. The South African table-land occupies the greater part of the Cape Colony. We may divide the Colony into two parts, the Orange River Region and the Coast belt. The Coast belt may again be conveniently divided into (*a*) the Eastern Region; (*b*) the South-Western, which very nearly coincides with the folded belt; (*c*) the Lower Karoo; (*d*) the North-West Coast region. The watershed dividing the Coast belt from the Orange River basin is, for nearly three-fourths of its length, over 4000 feet above sea-level. The principal feature of the watershed is the main range of the Drakenbergen. The Eastern Region rises in two terraces

of 1500 to 2000 feet, and 4000 to 4500 feet altitude. The rate of denudation, in this part, has been comparatively slow, on account of the presence of intrusive rocks. The South-Western Region is totally different in its physical structure from the Eastern Region. It is a mountainous district, with ranges running more or less parallel to the coast. The rivers flow in longitudinal valleys between the ranges, and find their way seaward by deeply cut transverse gorges. The rivers of the Eastern and South-Western Regions are all perennial streams. The best agricultural land is found in these regions. The remaining parts of the Colony, with the exception of a fringe of land on their eastern side, belong to the desert region of South Africa, but offer much suitable land for pastoral purposes. The South-Western and Eastern Regions have the greatest rainfall : the former gets its rains in winter, the latter in summer. Both these are also the most densely populated parts of the Colony, and show the greatest percentage of cultivated land. It is, however, evident that the dominant occupation in the Cape Colony is stock farming. In the South-Western and Eastern Regions, combined, there are thirty districts which do not produce enough cereals for their own wants, although these regions are the chief agricultural areas of the Colony. The richest districts are Paarl, Stellenbosch, Murraysburg, Victoria West, Barkly East. Taking into account the return from all sources, the Kimberley District is the richest of the Cape Colony."

This paper was followed by a series of three dealing with glacial phenomena, some at least of which we hope to publish here. These were a paper by Mr. A. W. Rogers on Glacial Periods in South Africa; one by Professor A. Penck, on Changes of Climate, as shown by movements of the snow-line and upper tree limit since Tertiary times; and one by Professor W. M. Davis on the Sculpture of Mountains by Glaciers. The last, as dealing with a much-debated subject, gave rise to a long and interesting discussion, in the course of which the balance of opinion seemed to be in favour of Professor Davis's view as to the glacial origin of hanging valleys.

On the following day, August 18, the proceedings of Section E were opened by a paper by Mr. Yule Oldham entitled the Unveiling of Africa. In this paper, which was illustrated by lantern slides, the author gave an account of the process of discovery of the African coast-line, and showed photographs of the earliest known maps. The next paper was one on Gough Island by Mr. R. N. Rudmose Brown, which, in the absence of the author, was read by Dr. A. J. Herbertson. It will be recollected that Mr. Brown has already contributed a paper on the visit of the Scottish National Expedition to this island to *The Scottish Geographical Magazine* (cf. our August issue, p. 430).

This paper was followed by one on the Indigenous Forests of South Africa, by Mr. E. Hutchins. He divided the forests into—(1) the dense evergreen indigenous forests, of which yellow-wood is the chief species, generally called the yellow-wood forests; (2) the open timber forests, which generally occupy drier country than the yellow-wood forest, and are of inferior type, though they may contain trees of first-rate importance, such as the cedar forest of Clanwilliam and the Rhodesian teak forest of Wankie; (3) the scrub forests of the dry hot coastlands and portions of the interior, where the rainfall is scanty and un-

certain. There is no timber of large size in the scrub forests, and not much in the open timber forests. The yellow-wood forests are found in the rainy regions of the south coast, where they appear as dense evergreen woods arranged in two stories.

The lower story consists of stinkwood, assegai, hard pear, ironwood, etc., and the upper story of the large yellow-wood trees, which attain the stature and dimensions of the largest oak-trees of Europe. For 1200 miles from Cape Town to the Transvaal the species remain much the same, but in the Rhodesian forests most of the trees are deciduous and of different species to those of the yellow-wood forest. Mr. Hutchins also discussed the best means of improving the indigenous forests of the country.

Mr. Hutchins was followed by Mr. Stewart, who read a paper on the Climatology of South Africa. He pointed out the great uniformity of the mean annual temperature, the Royal Observatory, Cape Town, Cradock, Bloemfontein, and Johannesburg being all about 62° F.—the higher altitude neutralising the lower latitude. The mean temperature curve is at a maximum in February, it falls rapidly till June, slightly to July, and rises with a peculiar flattening in September to the maximum. The minimum of the year occurs in the cold spell in July. The flattening in September is associated with an increase in the cloud curve coincident with the change in the prevailing winds from north-west in August, to south in September. As to rainfall, three regions can be made out: (1) the south-west winter rain region; (2) the small area of constant rains in the south, (3) the east with summer rains. Rain comes with north-westerly winds in the west, with south-westerly winds in the south and east, and sometimes with north-easterly winds in the east. Remarkable winds, locally called berg winds, blow from the plateau at right angles to the coast and raise the temperature. At Port Nolloth they blow when depressions are commonest in South Africa—from autumn through winter to spring—and make the temperature higher in winter.

On the same day an interesting paper on the Geology of South Victoria Land was read by Mr. H. T. Ferrar in Section C (Geology).

Mr. Ferrar said that the knowledge we had of South Victoria Land previous to the departure of the *Discovery* was mainly acquired by the expedition under Sir James Clark Ross in his ships H.M.S. *Erebus* and H.M.S. *Terror*, in the years 1839-1843. His discoveries might be briefly summed up thus:—(*a*) A great range of mountains, which rose occasionally to heights of 15,000 feet, and extended in a north and south direction for at least 500 miles; (*b*) the presence of volcanic and plutonic rocks in this area; (*c*) an open shallow sea south of the Antarctic circle; (*d*) an active volcano, Mount Erebus, over 12,000 feet high, emitting flame and smoke in great profusion; (*e*) a wall of ice, the Great Ice Barrier, on an average 150 feet high, and about 470 miles long. In 1899 the *Southern Cross* Expedition brought home from Cape Adare specimens of granites, basalts, and quartz slates, but unfortunately the latter proved to be unfossiliferous. The paper dealt with the volcanic islands off the coast, commencing with the Balleny group, in latitude 66° S., and passed on to the rocks of the mainland in latitude 77° S. The rocks from the islands were chiefly basalts and tuffs, though intrusions of

trachyte were fairly common. Edward VII. Land and the volcanoes on the mainland were included, as the latter, at any rate, belonged to the recent volcanic eruptions of the area. All the volcanoes were undenuded cones, usually situated in isolated positions, and contrasted strongly in outline with the rugged scenery of the main mountain range. The great range of mountains discovered by Sir James Ross had been proved to be at least 800 miles long, and to have some remarkable features common to the whole length. This great mountain range was divided into smaller ranges, to which distinguishing names had been given; but only one, the Royal Society range, had been examined in detail by the expedition. The rocks that composed the range were conveniently separated into four distinct groups—namely, gneisses, granites, sandstones, and dolerites. The gneissic rocks occurred at sea-level and below a sequence of rocks which was at least 12,000 feet thick, and might be safely regarded as forming the ancient platform on which the central part of South Victoria Land was built. The foothills of the Royal Society range and the lower portions of the Cathedral rocks were composed of this class of rock. The granites had been encountered at the north end of the Royal Society range, where they rested upon gneisses, and dykes of granite pierced the gneissic series. The Beacon sandstone formation was met with at a height of 4000 feet above sea-level, and about 40 miles from the sea. It appeared to be nearly 3000 feet thick, and near the top indeterminable fossil plants were found. The dolerite sheets produced the plateau-features characteristic of that rock, and capped the sandstone over a very large area. Dykes, sills, and pipes of the dolerite occurred in the sandstone, and proved the former to be intrusive. The ice—sea ice, produced by the freezing of the sea during the winter—was on an average 8½ feet thick, but during the summer the sea-water melted the lower surface of the ice. The moraines high on the slopes of Mount Erebus, and other moraines stranded at various spots, were considered in their relation to the past and present distribution of the ice, and the conclusion arrived at was that the glaciation was approaching a minimum.

At Johannesburg on Tuesday, August 29, the proceedings in Section E were opened by Mr. Douglas Freshfield, who gave an account of his travels in the Sikhim Himalaya and Tibet, in which he said that the first thing which a traveller remarked on coming up from the plains was that there were no sub-Himalayan lakes like the sub-Alpine lakes. There were no great moraines, and for the first 25 or 30 miles the hills were composed of rounded schist without precipices, the rain having washed them down without creating cliffs. Further north were lofty pinnacled summits, as picturesque as the spires of a mediæval town, while on the lower levels instead of crevasses there was a rough dune-like surface of ice and stones drained from the surface. After showing a number of slides illustrative of the country and its inhabitants, Mr. Freshfield by means of maps described his explorations in the Kanchenjunga district (cf. this *Magazine*, p. 174).

Mr. Freshfield was followed by Mr. Tudor Trevor, who read a paper illustrated by lantern slides, on the Physical Features of the Transvaal.

Mr. Trevor divided the country into three regions:—(1) the plateau country known locally as the High Veld; (2) the slopes of the plateau known as Banken; (3) the basement country, known as the Low or Bush Veld.

The plateau region may again be sub-divided into the true High Veld, stand-

ing at an elevation of from 5000 to 6400 feet, and the Middle Veld, standing at an elevation of from 4000 to 5000. The true High Veld comprises an area of about 14,900 square miles, and was described as the cream of the Transvaal from the farming point of view. The grasses are of excellent quality, endemic diseases among cattle are unknown, and epidemic plagues are stated to be less severe than in other parts. The soil, though not rich, is easily worked over large areas, and not too poor to repay working. The greatest drawback of the region is that the rains come at the wrong season. In spring, when water is needed for the growing crops, rain is often entirely wanting, while in autumn, when dry weather is required to mature the grain, it is often destroyed by heavy falls.

The Middle Veld consists of that portion of the plateau to the west of the Natal Railway line, and has an area of approximately 19,000 square miles. The soil is richer than in the High Veld, but more stony, and cattle diseases are rife. The whole of the plateau country, including 4400 square miles of outliers in Zoutspansberg and Waterberg, comprises 38,100 square miles, or 32 per cent. of the total area of the Transvaal and Swaziland.

The slope country, which is well watered and wooded, and has many attractions, suffers severely from various disadvantages: horses will not live, cattle are unprofitable, and malarial fever is so prevalent that the population has been driven out. The slope country with outliers includes a total area of over 27,000 square miles. All the rest of the country, comprising a total area of 52,500 square miles, consists of Low Veld, is practically devoid of stock, and is rife with malarial fever from one end to the other. It abounds in mimosa and other thorny scrub, quite useless for all purposes, while the soil is granitic and poor, with an occasional outcrop of igneous rock of exceptional fertility. Above 3000 feet Mr. Trevor does not think that malarial fever is worse than in Spain, and therefore should not interfere seriously with the white population, but below that level he does not think that the country would ever carry a white population.

Mr. Trevor then went on to describe the water system of the colony, the soil, and the springs. He drew attention to the fact that there was constant evidence of the drying up of springs and fountains. The common belief, to which he himself inclined, was that the white man's custom of burning off the grass every winter caused the ground to become hard-baked, and in consequence rain-water, instead of soaking in and later emerging as springs, tended to run directly off the surface and into the rivers. The subject is of great importance, as it threatens the existence of the whole of the inhabitants of the country.

The two final papers of Tuesday were one on the Triangulation of the Johannesburg gold fields by Mr. C. van der Steer, and one entitled Geographical Notes on Africa south of the Limpopo, by Mr. F. S. Watermeyer. Mr. van der Steer described in detail the very elaborate general survey of the Witwatersrand district which was undertaken by the Government in 1890. Mr. Watermeyer's paper appears in the present issue of the *Magazine*.

On Wednesday, August 30, the meeting of Section E was delayed to give the members an opportunity to hear Mr. Lamplugh's paper on the Victoria Falls in Section C. When the section met the first paper was that read by Captain Ettrick W. Creak, R.N., on Terrestrial Globes: a Necessary Adjunct in the Teaching of Geography. In this paper Captain Creak gave it as his opinion that the basis of sound geographical

teaching should be globes, and that maps should only be used to show the detail of small areas.

Subsequently Mr. J. Lomas gave a lecture, illustrated by lantern slides, on Excursions as a means of teaching Geography. Mr. Lomas was followed by Professor W. M. Davis, whose communication was entitled The Cycle of Geographic Forms in an Arid Climate. Assuming the existence of an arid region where the rainfall was practically *nil*, or so small that no rivers were formed, the water being absorbed before travelling more than a short distance, he endeavoured to show the inevitable action of such conditions upon the surface of the country. Starting with a rough and uneven country, he showed that when slight rainfall occurred the water would run down the slopes and collect in the hollows. In course of time the slopes would be worn down until two or more basins joined, then gradually the waste would all become deposited in the lowest basin.

It would not remain a flat surface, for wind effect must be taken into consideration, particularly in such an arid region. The wind would blow the waste about and remove it, and the surface rock would be exposed or only slightly covered, and eventually the surface might be planed down below the level of the ocean. He thought "pans" might be the result of wind excavation in a more arid period than now prevailed.

An interesting discussion followed the reading of the paper, in which the bearing of the theory upon the origin of the present condition of the Kalahari Desert, as well as of the numerous pans, particularly in the Lake Chrissie district, near Ermelo, was discussed. In reply to questions Professor Davis said that he did not consider it at all improbable that another Kalahari Desert might be in process of formation in South Africa, and he was not altogether sanguine that such a calamity could be averted by tree-planting.

Subsequently Mr. C. D. E. Braine read a paper entitled "Notes on Irrigation in South Africa."

The final meeting of Section E was held on Friday, Sept. 1, when the proceedings opened with a paper by Major Stevenson Hamilton, D.S.O., on the Game Preserves of the Transvaal. A paper by Mr. J. Bolton on Boundaries and Areas in Africa followed, and the proceedings closed by a paper by Dr. A. J. Herbertson and Mr. P. C. Waite on a New Rainfall Map of Africa, an abstract of which follows.

Two years ago, when preparing the Atlas of Meteorology in conjunction with Mr. Bartholomew, one of us found it necessary to make a new rainfall map of the world. In Africa the necessary data were almost non-existent outside Cape Colony and Algeria, except for a year or two at some coast stations, and at those being started under the auspices of a British Association Committee and those of German colonies. At these stations ten more years of observations have since accumulated, and a large number of new stations have been started which enable us to give a somewhat more reliable map of the rainfall of the continent. In the present map the shorter period observations have been utilised when others did not exist in order to determine the outs and ins of the rainfall lines, but wherever possible the final position of the lines has been adjusted to the values of the

stations with longest means. Even then no one can be more conscious than the authors of the imperfections of the map. In it the dotted lines indicate the lines based on other than direct measurements of rainfall. The continuous lines may be taken as showing roughly the main characteristics of African rainfall, while the dotted lines are surmises based on travellers' accounts of rainfall and vegetation.

The scale of the map is small, and for this reason many minor details indicated even by the existing figures are omitted. While the map is only a first approximation to a summary of the distribution of rainfall in Africa, it shows clearly a number of points of great geographical interest.

While the general distribution is similar to that in other maps, we have been able to draw a number of lines with greater precision and to revise the mapping of certain areas. For instance, the newer data enable us to join up the Central African heavy rain area with Abyssinia, a point not before settled. Again, a number of observations close to the edge of the Drakenberg escarpment, though still for a very short period, enable us at least to conclude that the upper part of the Drakenberg is wetter than the hilly land of the terraces of Natal, and that in all probability this is due to the scarped edge of the tableland further north. One doubtful matter, of great importance to South Africa, cannot be settled, and that is the bending of the rainfall lines along the eastern margin of the Kalahari Desert. If there were only as great a number of rain gauges in Bechuanaland as there are in German South-West Africa, this important matter would be settled, at least in a rough way, in another decade. These are essential also if we are to discover whether there is any permanent drying up, or whether, as is more probable, there is a succession of drier and wetter periods.

The heaviest rainfall of all occurs round the Kamerun Mountains, where one station, Debunja, has an annual precipitation of 10,454 mm., *i.e.* roughly 400 inches—not much less than that of Cherrapunji in the Khasi Hills of India, so that Africa has thus the second heaviest rainfall station known. In 1902 at this station the enormous rainfall of 14,133 mm., *i.e.* about 560 inches, was recorded. At the other end of the scale you have such places as Walfisch Bay and Suez with less than one inch of rain, and parts of the desert which are probably drier still—one heavy thunderstorm falling in a decade or two.

Looking at the map as a whole, the striking features are (1) the belt of wet climate round the equator, broken by a drier area near but not touching the east coast. (2) The dry belts round the tropics which do not extend quite to the east coast in the south. (3) The wet south-west and north-west corners. (4) The continuous wet area of varying width which fringes the east coast from Cape Colony to the equator.

In order to apply the data of such a map to a particular region, it is necessary to take into account the local configuration. On the High Veld here this should not be difficult, for the land forms are few and of simple types. A few rain-gauges properly distributed on and round each type of kopje should, in a few years' time, yield invaluable information on the distribution of rainfall on and round each land form. Then, using the average shown on the general map, it will be possible to say—on this side or exposure the precipitation will be so much above or below the average.

The map for economic purposes requires to be supplemented by several others. Thus, it is not only the total annual precipitation which is of importance; the time of year at which it falls, and the nature of the fall at each season, have also much bearing on vegetation and cultivation. Such a map shows that places having the same annual rainfall may yet have very different climates on account of

the different periods of the year at which the fall takes place. Again, maps showing evaporation and run-off are also required in addition to good topographical ones, before the rainfall can be said to be fully investigated. For much of South Africa the information upon which such map might be based does not yet exist.

Of the general lectures mention should be made of one on the Mountains of the Old World, delivered by Mr. Douglas Freshfield at Durban on August 21, and one on the *Discovery* Expedition, by Mr. Ferrar, at Pietermaritzburg on August 23.

A striking lecture on the Rhodesian ruins was also delivered at Bulawayo on September 9 by Mr. Randall MacIver. The lecturer came to Rhodesia last April under the auspices of the Rhodes trustees and the British Association, and has made a detailed study as far as time permitted of the ruins of Inyanga, Niekerk's farm (16 miles north of Inyanga), Khami, Dhlo Dhlo, Umtali, Insiza, and Zimbabwe. After careful investigation he has decided that none of the ruins in Southern Rhodesia is older than the fifteenth or sixteenth century, and that they are the handiwork of African natives of the negro or negroid race under the dynasty known by the collective name of Monomotapa. The bases of these conclusions were formed on the following data :—

The buildings are essentially of a native kind or type common to-day ; nearly all retain some original wooden stakes enbedded in the walls ; there is no trace of inscriptions on any of the ruins ; stone and iron implements were found together ; neither the buildings nor the other articles found show traces of early Oriental or European influence ; finally, the discovery of blue and white Nankin china and other articles of mediæval manufacture in the lowest parts of the foundations proves that such commodities were the object of barter before the buildings were erected. In the case of Zimbabwe, he controverts the statement that the foundations show a series of layers of different periods ; but he admits that in one layer of sand charred wood found some way below the previous excavations may indicate an earlier period, though this is unlikely. Mr. MacIver maintains that the ruins were originally fortified places, usually enclosing a kopje built in the form of a rough ellipse following mainly the contour of the surrounding country. The so-called slave pits, described as pit dwellings, were originally citadels of their strong places round which concentric circles of walls were built. Zimbabwe, as the residence of Monomotapa, was more carefully and elaborately built than the others, but its plan is essentially the same. The elliptical temple would therefore be an Ibual fortress. The soapstone birds discovered by Mr. Bent represent totems. A race still exists —Kaffir tribe—with an eagle totem. The Niekerk ruins, which cover an area of 50 square miles, include nine hills each representing a unit ringed with concentric walls, one having 37 lines from valley to summit.

At a meeting of the General Committee of the British Association held in London at the beginning of November, it was decided that the York meeting in 1906 should take place in August, the exact dates to

be announced later. The President of this meeting is to be Professor E. Ray Lankester. The meeting in 1907 is to take place in the town of Leicester.

SIBERIA: A REVIEW.[1]

(With Illustrations.)

In a review of *The Rockies of Canada*, by Walter Dwight Wilcox, F.R.G.S., which appeared in this *Magazine* in April 1901, we invited the attention of the members of the Alpine Club to a new sphere for their enterprise and exertions, and we quoted a few stimulating sentences from Mr. Wilcox. "The Rockies of Canada offer exceptional opportunities to the mountaineer. The time has not yet come when the climber must travel far into the wilderness to find peaks that have never been attempted. There are hundreds of unclimbed mountains within a few miles of the railroad, and it may safely be said that mountaineering in the Canadian Rockies is now making its early history. Few other easily accessible ranges in the world possess the rare charm of the unexplored wilderness, where each attempt is a reconnaissance for the best route, and every view is looked upon for the first time by human eyes." We may be permitted to doubt if the members of the Alpine Club have by this time completed the task of climbing and exploring the Canadian Rockies; but nevertheless we have much pleasure in inviting their attention to the very interesting work now before us, in which another Fellow of the Royal Geographical Society, Mr. Samuel Turner, describes how he has been the first Englishman to break ground in climbing and exploring another range of mountains in a very different part of the world. The range bids fair to rival the Rockies in the charm and attractions of novelty, difficulty, and extent. Undoubtedly it is not so well known as the Rockies, and although it is distinctly off the beaten track, yet it is fairly accessible, and it offers to the adventurous mountain-climber an admirable field in which to court fresh excitement and to win new laurels. We refer to the Altai or Golden Mountains, which are situated in the southern part of the province of Tomsk, in Siberia, and are bounded on the west by Mongolia, and on the south by the province of Kokpektinsk.

An explorer who decides to tackle the Altai mountains must be prepared to devote some ten weeks to the business, of which, however, only two will be spent in actual climbing, exploring, or hunting. Mr. Turner, in a most useful appendix, sketches a programme of when and how such an expedition can best be made, and he estimates the cost of the journey, exclusive of climbing and exploring outfit and expenses, at from £168 to £178. Having found his way to Moscow, by whatever route he prefers, the would-be explorer proceeds by the Siberian railway as far as the Obi river, which he crosses, and there he leaves the train. From Obi station he proceeds south by tarantass, or sledges, or drosky,

[1] *Siberia: A Record of Travel, Climbing, and Exploration*, by Samuel Turner, F.R.G.S. London: T. Fisher Unwin, 1905.

via Rysk to Katunda, which is situated in 86·10° East longitude, and will be his base of operations. The distance between the Obi station and Rysk is about 160 miles, and presents no special difficulties to the traveller, who, unlike Mr. Turner, selects the proper time of the year for his journey. The distance between Rysk and Katunda is about 200 miles of very bad road; Mr. Turner, travelling in the depth of winter, took three days and three nights to the latter part of the journey, and changed horses and sledges nine times. The highest elevation over which he passed was on one of the passes of the Korgomskië mountains, 5000 feet above the level of the sea. At Tomsk he had the advantage of a long consultation with Professor Sapozhnikoff, who, on a former occasion, had made an unsuccessful attempt to climb Belukha, which was supposed to be the highest mountain in Siberia and to be 14,800 feet above the level of the sea. By way of preparation for the ascent of Belukha, Mr. Turner, a day or two after he reached Katunda, made the ascent of several peaks of Saptam mountain, and found them all 10,000 feet high or a little over it. Two days' marching over very bad roads took him into the circle of the Katunskië-Belki range, the principal peaks of which have an average height of 14,000 feet. The next day was wisely assigned to observations and experiment, and Mr. Turner notes regarding the Belukha glacier that there were no crevasses. "The ice also was uncommonly hard. I made one or two experiments to see how much the glacier would move, and, as far as I can judge, the glacier does not move more than at the rate of about one foot in twelve months. I am sure the ice is as stationary as any glacier in the world." He also ascertained that a very serious danger was from landslips or rather rock-slips. "Instead of the Siberian climber looking for single stones, as he would in the Swiss Alps, he runs the risk of a few thousand tons of the mountain falling his way." Next day Mr. Turner and his hunter together climbed to a height of 13,000 feet, and then the hunter declined to go any higher, so Mr. Turner, selecting his own line of ascent, continued to climb till he had reached the top of a peak from which he could command a full view of Belukha, which, according to his measurement, is 17,800 feet in height. We must allow Mr. Turner to describe his own sensations as he gazed on the wonderful scene. "There is a wealth of beauty in the snow-clad summits of the Alps when the sun is upon them, as seen from some neighbouring peak. I have gazed at Mont Blanc from the summit of the Matterhorn, and at the Matterhorn from Mont Blanc, and some of the grandest views in Switzerland, but the northern faces of the Katunskië-Belki range, with the crystal clear glaciers hanging in the sun and sparkling like diamonds, form a picture so striking and beautiful that any experience can offer no parallel to them. It is mere commonplace to say that it was the finest view I had ever beheld. The wind was intensely cold, and the mountain seemed to draw nearer, the glory of the panorama before me making me wish for some one with whom to compare impressions. One peak in especial, of a shape reminiscent of the Matterhorn, but having an obelisk of rock about 2000 feet less than that of the famous Swiss mountain, particularly impressed me. It stood out among its

comrades with such imposing grace that it was difficult for me to remove my eyes from it. The indescribable beauty of the view before me, and

Katunskiê-Belki, with Willer's Peak, 17,800 ft., on extreme right.—(From Turner's *Siberia*.)

the consciousness that I was gazing upon a scene that had never yet been desecrated by the camera, or described by any human being, was

one of a lifetime, and amply repaid me for the difficulties and inconveniences I had experienced on the way. Here all was virgin ground. There were no passes known and labelled; no Mark Twain had ever made the ascent of these peaks in imagination; no telescope had scaled their heights before my Zeiss binocular; no avalanche had hurled its victims to an untimely death; no Alpine hut vulgarised the slopes or ridges, or obscured the view of the summit; no Baedeker enumerated the guides or reduced the glories of the ascent to a matter of pounds, shillings, and pence. I was in the home of the maral, the marmot, the ibex, the bear, and the red Alpine wolf; when the summer came the mountain slopes would be alive with the song of countless myriads of birds and the hum of numerous insects, unmolested by civilisation and unhunted by man.

"I found myself wondering whether, when the great Mogul race was predominant in Asia, some stray adventurer had ever visited these mountains, or whether they too had dreaded them as the Kalmuck and the moujik dread them to-day. It is certain that this particular cluster of mountains is altogether off the line of the caravan route from Omsk to China; or the Mongolian sheep-hunter's route, *viâ* Onguadi; and this fact, coupled with the comparative isolation of Siberia from the west of Europe, would account for my having had the great honour of leading the way to the exploration, a lead which, I hope, will soon be followed, of a land far excelling Switzerland in its wild Alpine beauty. I am confident from what I saw that the range contains mountains of even greater altitudes and magnificence than those I have described. A host of thoughts crowded through my mind as I stood amid those rugged giants of the Altai. The word Altai means gold, and golden mountains they appeared to be as they reared their mighty crests in the rays of the slowly descending sun; and later, when the afterglow rested upon them, the scene was such as no Alpine sunset can reproduce or simulate, beautiful though the peaks, like the Matterhorn, are under like conditions. Not a bird sounded its call, no rippling stream was to be heard, no avalanche raised the echoes with the thunder of its fall, no Alpine cow-bell sounded in the distance; a silence that could be felt rested on all around me. Yet, in the silence, the stately mountains seemed to welcome me and to invite a closer acquaintance. The frozen river lay in its winter sleep beneath me; the lakes in their ice-sheets slept peacefully beyond. In the distance were the pure white snow-fields; around me scores of glaciers clothed the slopes and precipices. The summits dreamt in the glow of the closing day. The sky was clear, and of a beautiful blue tint. I felt that my journey had not been in vain."

The next day was devoted to ibex-shooting. Mr. Turner to his own rifle got three, one of them with a horn 42 inches long and 10 inches thick. Two days after this he attempted the ascent of Belukha under anything but comfortable circumstances. He had spent a miserable night alone in a small tent at an elevation of 11,000 feet; his companions had declined to remain in such a cold, wind-swept spot. They had promised to return at 4 A.M., but when they failed to do so, he set forth on his adventurous task alone. We must refer our

readers to his own account of how he fared on the way, and how he failed to reach the summit, although apparently within 150

Katunskié-Belki, with Belukha West Peak on extreme right, from height of 11,000 ft.—(From Turner's *Siberia*.)

yards of it; but one incident of the ascent was so remarkable that we extract it for the benefit of our readers. "I had noticed that this western ridge was not so long, and persuaded myself, that as it was shaded from the Arctic winds, the ice might be softer. So I determined

to try it, although I knew well enough that the snow was soft, and an avalanche exceedingly likely. I had come a long way and was not inclined to give in without a struggle, even if it involved some risk, so I started very carefully; but after going on for about six yards, I suddenly became aware that the snow was giving way beneath me, and the next moment I was on the top of a billow of loose snow that was gliding down the mountain side, considerably more swiftly than was either comfortable or safe. I had concluded that it was all over with me, and that an obituary notice was perhaps the thing I should be requiring next, when the motion stopped suddenly. I immediately relinquished hold of my ice-axe, and knocked the snow away from about my head, until I was able to breathe freely, but my body was crushed down in a most uncomfortable manner. I pushed away the snow and secured the head of my axe, and using it as a lever, was presently able to wriggle myself out of the snow. The snow had gone down my neck, making me very wet and uncomfortable. I brushed away as much of it as possible. Then I began to crawl, the ice-axe serving to drag me along, while with the disengaged hand I managed to secure a hold of any protuberance that offered, however small. In this manner I advanced slowly, foot by foot, well aware all the time, that if I was so unfortunate as to start that avalanche on its downward career once more I would most certainly be precipitated on to the ice below and killed. In spite of every care, however, my knees slipped on a smooth piece of ice, and I felt myself gliding again. To save myself, I threw myself flat and lay for a second, until I could get a better hold with the axe and scramble to my knees again. I now remembered my knife, so I got it out, and opened the short blade which I used for opening tins. This was a great help, and with its aid and that of the axe, I managed to regain the ridge."

On his way back to camp after this prolonged and violent exertion, Mr. Turner found himself very ill, the result, he suspects, of having swallowed some solder from a tin of soup, and as his eyes were suffering from severe inflammation, he decided to give up the attempt to reach the summit and to wend his way back to Katunda and comparative civilisation. But we have said enough to show that the chapters in this book devoted to mountain-climbing and exploration are replete with interest to the mountaineer, to the sportsman, to the geographer, and to the geologist.

The chapters on the Altai range, however, are but a small part of this book, the bulk of which is devoted to a totally different and much more prosaic subject, albeit one of much interest to the merchant and economist. Mr. Turner's principal object in visiting Siberia was to ascertain the possibilities of developing what is fast becoming a very important trade between Russian Siberia and England, viz. that in dairy produce, more especially butter. In pursuance of this he has accumulated a great deal of information and statistics which are well worth the serious attention of others than those engaged in this branch of commerce.

The opening of the Siberian Railway, the cost of the construction

of which Mr. Turner underestimates, we think, at £78,000,000, while its working expenses are nearly £5,000,000 annually, gave an extraordinary impetus to the trade. In 1898 the number of dairies was only 140 and the exports 48,360 cwts.; in 1904 there were 2630 dairies and the exports were 681,857 cwts. It is estimated there are now twenty-five millions of cows in Siberia, where there is abundance of rich pasture-land and cheap and plentiful fodder during the winter months. The average life of a cow in Denmark, the reputed headquarters of dairy farming, is from seven to eight years, while in Siberia it is ten years. In Denmark, 28 lbs. of milk are required to produce 1 lb. of butter; whereas in Siberia 19 lbs. of milk in winter and 22 lbs. in summer suffice to produce 1 lb. of butter. There are over 250 co-operative dairies in Siberia, and the Russian Government assists liberally in starting others. Special arrangements have been made by Government for the swift carriage of butter from the centres of the trade to Moscow, whence it is taken to Rewal and Riga, where there are two regular lines of steamers to convey it in refrigerators to London, with the result that last winter in one week between seven and eight thousand casks of Siberian stall-fed butter were placed upon the London market. The quantity exported annually from Siberia is no less than eighty millions of lbs. These figures give food for reflection to the dairy farmers of the United Kingdom and the Colonies, especially as, according to Mr. Turner, the trade from Siberia to England is only in its infancy.

We have had so many books within the last half-dozen years describing Russia and Siberia, that it is unnecessary for us to give even an epitome of Mr. Turner's views on such vexed questions as exiles, criminal and civil administration, the railway system, and the like, but we must remark that he is evidently an acute and careful observer, not only of such matters as were relevant to the business he had in hand, but in all matters which came under the observation of a keen, intelligent, observant man of business in a foreign country, and he sets down his impressions in perspicuous and graphic style. As is natural under the circumstances, Mr. Turner is undoubtedly a Russophil, and while honestly endeavouring to be impartial, he puts the best construction on everything that the Russian Government does. He is most anxious that Russia and England should become the best of friends, and he says quite frankly that he believes "the maintenance of our commercial supremacy depends more upon a friendly understanding with Russia than upon our military alliance with Japan"; and again, "We must look forward either to surrendering the greater part of our commerce with Asia to the Japanese, or we must fight them by finding a field of cheap products, and this we can only hope to find in Russia and Siberia." These propositions are at least debatable, but the pages of this magazine are not the place in which they can be discussed. But the war in the Far East is now over. Japan herself has held out her hand in friendship to her formidable antagonist, and England will not be behindhand in striving to promote what Mr. Turner so wisely desiderates, viz. "the policy of seeking at all

times to preserve to ourselves the goodwill of a generous and friendly nation."

We must not omit to add that this book is embellished with a profusion of excellent photographs, and that we are indebted to the publisher for permission to reproduce some of them.

GEOGRAPHICAL NOTES.

Asia.

The Island of Sakhalin.—It is announced that the Japanese Government has renamed the island of Sakhalin, as well as most of its important bays and districts. To the island itself the Government has restored the old Aino name of Karafuto—a change which is probably justifiable enough; but the other changes, as indicated below, constitute a dangerous precedent, and one which, it is to be hoped, will not be widely followed.

The more important of these changes are as follows:—

Old Name.	New Name.
Strait of Tartary.	Mamiya Strait.
Amur Gulf.	North Mamiya Strait.
Aniwa Bay.	Higashifushimi Bay.
Lososi Bay.	Chitose Bay.
Patience Bay.	Shichiro Bay.
Endma Point.	Tsushima Point.
Cape Crillon (Cape Notoro).	Cape Kondo.
Cape Siretoko (Cape Aniwa).	Cape Jiuzo.
Cape Patience.	Cape Kataoka.
Moneron Island.	Todoshima.
Robben Island.	Kaijioto.
Korsakoff.	Kushunkotan.

The Strait of Tartary takes its new name from Mamiya Rinzo, a venturesome Japanese explorer who circumnavigated Sakhalin early in the nineteenth century. The present military operations have revived much of the history of Mamiya Rinzo. It was in the sixth year of the epoch Bunka, corresponding to 1809, that he did his work. The secret that Sakhalin was in reality detached from the mainland was locked within closed Japan, for in 1855 a British fleet operating off its west coast made the remarkable error of imagining that it had the Russian fleet blockaded in a *cul de sac*. Prince Higashifushimi, who commanded the *Chitose* in the chase and destruction of the *Novik*, is honoured in renaming Aniwa Bay, and Lososi is renamed for the *Chitose*. Patience Bay is rechristened after the personal name of Admiral Kataoka, and Endma is renamed for the cruiser *Tsushima*, which actually drove the *Novik* ashore. Notoro gets its new title from Kondo Jiuzo, an explorer dispatched to the island by the Shogun in 1802. Cape Patience takes Admiral Kataoka's name, and the personal name of Kondo the explorer

is given to Cape Aniwa, or Sireteko. To Korsakoff, the most important town in South Sakhalin, the old Aino name of Kushunkotan has been restored. Alexandrovsk has not yet been renamed, but it is expected that some designation, historical or commemorative, will be bestowed upon it. Under the new order Alexandrovsk will continue to be the capital.

According to the latest statistics of Sakhalin or Karafuto, the Russian population is as follows :—

	Freemen.	Convicts.
Male, . . .	5319	19,770
Female, . . .	4478	2397
Total, .	9797	22,167
Grand total, . .	31,964.	

It is not stated whether this includes the native population.

It will be recollected that by the Treaty of Portsmouth, N.H., the island of Sakhalin or Karafuto is divided between the two Powers concerned, Japan taking the portion to the south of the 50th degree of north latitude, and Russia the portion to the north of this line. The result is that by area Russia retains three-fifths of the island, but on the other hand Japan's portion commands the Strait of La Pérouse, and valuable fisheries. The part of Karafuto ceded to Japan includes approximately 12,000 square miles.

French Expedition to Central Asia.—An important French archæological expedition to Central Asia, according to an announcement in the *Siècle*, is to be undertaken by M. Pelliot, Professor of Chinese in the French College of the Far East at Hanoi, and Dr. Vaillant, son of the eminent professor of that name. The mission, which is being sent out by the Minister of Public Instruction, the Academy of Inscriptions and Belles-Lettres, the Geographical Society, and the French Asiatic Committee, has for its object the discovery of monuments of the ancient Turko-Buddhist civilisation before the conversion of the Turks to Mohammedanism. M. Pelliot will undertake the archæological investigations, while Dr. Vaillant will pursue studies in natural history and geography. They will be accompanied by a French photographer, and will proceed first to Kashgaria, whence they will travel steadily eastwards, arriving ultimately at Pekin. The party expect to be absent about two years.

Dr. Sven Hedin's New Expedition.—Dr. Sven Hedin arrived at Constantinople on October 21 from Stockholm, and announced to Reuter's representative his intention of leaving in a few days for Tiflis, Erivan, Tabriz, and Teheran with the object of organising a caravan for exploring and surveying work in the Dashtikavir and the Dashtilut, these salt deserts of Eastern Persia being, he stated, practically an unknown region. This work will occupy the whole winter, which will be passed almost entirely in the desert, although the explorer will keep in touch

with the oases and water-springs. Thence Dr. Sven Hedin will proceed to Baluchistan and India, arriving in the latter country at the beginning of the spring. He will stay some time in order to organise an expedition to Tibet, the unknown highlands of which he will explore, and generally endeavour to complete the work on which he has been engaged at intervals for the last twenty years in that country, filling up gaps in the maps. The necessary instruments for geographical surveying and astronomical observations have been dispatched to Calcutta, there to await the arrival of the famous traveller, to whom the Indian Government has promised to afford every facility.

Beyond this brief telegraphic summary no further information in regard to Dr. Sven Hedin's plans appears to be available, as he has apparently not announced his intentions to any of the Geographical Societies.

The Province of Berar.—By an arrangement with the Nizam of Hyderabad, the province of Berar was, during the month of September, added to the British Central Provinces of India. Since the treaties of 1853 and 1861 the province has been administered by British officials, the surplus revenue being assigned to the Nizam; but henceforth, by the new arrangement, it becomes an integral part of the Empire. The six districts which have hitherto existed have been reduced to four, known as Amraoti, Akola, Buldana, and Yeotmal, which now constitute a division of the Central Provinces. Within the uplands of the region is included the beautiful sanitarium of Chikalda, placed at a height of 3777 feet. But the future of Berar lies in the development of the cotton fields, which are rapidly rising in importance. The chief market is Nagpur, whence the produce is exported to the Bombay market. Berar also contains coal deposits of apparently considerable value. But it is upon cotton that it chiefly depends.

Africa.

Expedition to Mount Ruwenzori.—Towards the end of October an expedition, consisting of Mr. H. B. Woosnam, the Hon. Gerald Legge, Mr. C. D. Dent, and Mr. Mitchell Carruthers left London for East Africa with the intention of proceeding to the Ruwenzori Range, which lies on the boundary between British East Africa and the Congo Free State. The primary object of the expedition is to investigate the flora and fauna of this region, and it goes out under the auspices of the British Museum Natural History Department. The party expects to be away about two years.

The Climate of the Bahr-el-Ghazal.—In *L'Esplorazione Commerciale* of Milan for September 30, there appears an interesting note on the climate of the Bahr-el-Ghazal and its effect on the health of Europeans.

The writer, Signor Tappi, has a record of ten years spent between Assuan and the Sudan, and therefore speaks with some authority.

The paper records meteorological observations made during two years, 1900-1 and 1904-5, taken partly at Lull south-west of Kodok, and partly at Mbili. The author divides the year into a dry and a rainy season: the dry ranging from October till April, when the wind is from the north and north-east; and the rainy from May till October, when the wind is from the south and south-east. Signor Tappi unfortunately broke his hygrometer during his observations, which he regretted, as he wished to record the high degrees of humidity during the rainy months. The paper is primarily addressed to those Italians who may be wishing to emigrate, and to them Signor Tappi offers the following observations:—

The dry season, in spite of its greater range of temperature, is much more tolerable than the wet, and therefore should be selected as the season in which to begin one's tropical life.

As the result of personal observation, and of discussion with Dr. Ing. Heiberg, of the Congo Free State service, Signor Tappi emphasises the necessity of hard work and regular exercise for the preservation of health. He even says that of the two, the artisan and labourer, the man who works with his hands, has a much better chance than the man whose work is intellectual, and he therefore recommends that artisans rather than brain-workers should emigrate to these regions.

While in the region of the Congo Signor Tappi met Dr. Heiberg, who at that time was the only doctor in the Enclave of Ladò, and on his remarking how much more vigorous the Europeans of the Congo Free State seemed to be in comparison with Europeans elsewhere in Africa, the doctor replied that it was entirely owing to the activity of their ordinary life that the officers were kept in good health; he had advised the Congo Government so to arrange its affairs that every one of its agents should be obliged to make "*at least one month of excursions on foot during each year.*"

America.

The Nordenskjöld Expedition to South America.—Baron Erland Nordenskjöld, who has recently returned from his expedition to the Andes (cf. this *Magazine*, vol. xix. p. 658, and vol. xx. p. 160), has communicated to Reuter's Agency some details of his work. He visited in all three tribes, the Yamiacas, Gurayos, and Atsapuacas, who, until a couple of years ago, lived like people in the Stone Age, and found that the two last in the main retain their primitive customs. No white man had previously visited the Atsapuacas, but they possess tools obtained through other tribes. The expedition found the Quichuas and Aymaras, which live round Lake Titicaca and in the fells of the Andes, a very interesting study for the ethnologist, as they retain many customs unaltered or but slightly modified since the time of the Incas.

Australasia.

Volcanic Eruption at Samoa.—The U.S.A. Consul-General at Apia, Samoa (cf. *Science* for October 6), reports that between August 2

and 4 last a new volcano broke out in Savaii, about eight miles east of the old volcano Mangi, and ten miles south of Matautu. The activity of this volcano has been phenomenal, for in a single fortnight it created a new mountain with three peaks, one of which was not far short of a height of 800 feet, or 2000 feet above sea-level. The ejected matter represents many millions of tons of rocks, slag, cinders, and ash. At the beginning of the outbreak this mass was moving towards the sea, that is, towards the settled part of the island. At the date when the Consul wrote, however, the mass had practically come to a standstill, and then measured about five miles long and one-fourth of a mile wide.

A note in *Nature* reports that a further eruption took place in the Samoan Islands on August 21. This eruption was preceded by a violent earthquake shock, which destroyed a large number of buildings. During the eruption large masses of material were ejected. Dr. W. H. Solf, the German Governor of Samoa, reports that on September 17 the volcano was still active, and was visible at Apia, fifty miles away.

Polar.

The Mylius Erichsen Expedition.—Some further details have come to hand regarding the plans of this expedition (cf. our last issue, p. 609). The intention is to make a start about the middle of June 1906, on board the *Denmark*, the party consisting of twenty-one persons, among whom will be a zoologist, a painter, a doctor, a botanist, and a biologist. Seventy sledge-dogs and some motor boats are to be taken. The vessel is to be steered for the East Coast of Greenland, and it is hoped that a harbour may be found in lat. 70°. From this harbour an expedition consisting of twelve men with sledges and dogs will start in March 1907 for the extreme north, where its members hope to map part of the unknown coast of eastern Greenland. This party is expected to return in July 1907, and if conditions are favourable it is contemplated that another party may be sent into the interior, or may even attempt to cross the country from east to west in a high latitude, say along the 70th or 75th parallel. The expedition is expected to finally return in the summer of 1908, and the sum of £11,000 is given as its probable cost.

International Antarctic Exploration.—Following up the resolution passed at the Mons Congress (cf. our last issue, p. 610), it is announced that Mr. Henryk Arctowski, late of the Belgian Antarctic Expedition, is engaged in developing a scheme for the international exploration of the South Pole. He proposes to begin the systematic exploration of the Antarctic regions by a preliminary circumpolar expedition, which is to be organised in Belgium, and is to leave Antwerp next autumn with the object of exploring the most unknown portions of the Antarctic in the hope of finding new lands and suitable places for the establishment of winter stations. These would be utilised by future expeditions, the intention being to establish a series of scientific stations in South Polar regions. Mr. Arctowski proposes to utilise an automobile of special construction to penetrate the interior of the Antarctic

Continent. If the experiment proves a success, it might be possible to set up a station far within the continent, whose scientific data would add greatly to the value of the observations made at the other stations which it is proposed to establish.

Amundsen's Expedition to the Magnetic Pole.—It is announced that a letter from this expedition reached Christiania *via* Canada on October 31. The letter is undated, but a photograph which is enclosed bears on the reverse side the words "Summer, 1904." It is, therefore, probable that the letter was sent off about that time. It runs as follows:—"In harbour 68° 30′ N., 96° 10′ W., King William's Land. We arrived here on September 9, 1903, and have been occupied the whole time with scientific work. All well. We have met friendly Eskimos of various tribes. We have dispatched our mail to Chesterfield Inlet, in Hudson Bay, by Eskimo from there. We are living on reindeer and salmon. The lowest temperature has been 61°·7 below zero. The ice conditions on our arrival were excellent but deteriorated during the summer. We hope to reach San Francisco in the autumn of 1905. Therefore send letters there. If we do not appear in 1905 do not be alarmed. The *Gjöa* is strong, and can withstand all difficulties. Have sufficient provisions and petroleum." The last news of the expedition was dated August 1903, and is detailed in our March issue (p. 156).

Two further letters, of considerable length, appeared in the *Times* of November 14. These are unavoidably held over on account of want of space.

General.

The Exploration of the Indian Ocean.—A communication from Mr. Stanley Gardiner in *Nature* for October 5 describes the progress of the *Skylark* Expedition (cf. this *Magazine*, pp. 336 and 562). The present communication gives an account of the Chagos Archipelago, and is written from Mauritius, where the vessel arrived on August 5, after a prolonged stay at the Chagos.

The work at the Chagos had been of an arduous nature, having been complicated by the unexpectedly heavy weather experienced, but the results are valuable both from the scientific and the practical point of view, previous surveys having been somewhat perfunctory.

The soundings taken on the cruise from Ceylon to the Chagos and from the latter to the Mauritius show that the archipelago is closely surrounded, both to the north and to the west, by the 2000-fathom line, and that there is at the present time no trace in the topography of the Indian Ocean of any former connection of the group with either the Maldives or the banks on the Seychelles-Mauritius line. The Chagos Archipelago appears, indeed, to stand by itself, being built upon a plateau rising to a depth of 800 fathoms in an ocean of an average depth of 2300 fathoms. Previously there were no bottom soundings between the banks and shoals of the group, but now a large number have been made, and these show depths of 400 to 800 fathoms between the individual banks.

Broadly speaking, the Chagos group may be said to consist of three atolls to the north (Salomon, Peros Banhos, and Blenheim), the Great Chagos Bank in the centre (60 miles by 90), and the two atolls of Diego Garcia and Egmont to the south, besides certain submerged banks both to the north and south. Of these the expedition has re-charted Salomon and parts of Peros Banhos, while the southern atolls have in addition been carefully examined. Salomon was very carefully surveyed, and the result is to show that in this instance the steep round the atoll is simply the slope at which coral and other remains from the reef above come to rest in the water. There is no evidence of any upward growth being in progress between the different Chagos banks.

The reefs of the archipelago are not in any way remarkable except for the extraordinary paucity of animal life. There is no green weed, but its absence is made up for by enormous quantities of millipores, especially Lithothamnia, which practically form the outgrowing seaward edges of the reefs. Indeed, were it not for the abundance and large masses of these organisms, there would be no atolls with surface reefs, etc., in the Chagos. The general impression gained is that Chagos has been for a long time an area of rest, and that the present condition of its reefs is mainly due to agencies still in action.

The marine fauna, as stated above, is poor, being more temperate than tropical in character. The land fauna depends upon the flora, and this, save in certain localities, has been largely destroyed to allow for the planting of cocoa-nuts. The shores are everywhere fringed with *Scævola koenigii* and *Tournefortia argentea*, both covered with a climbing bean. Behind these there was originally a forest formed of immense mapon (*Pisonia capitata*) and takamaka (*Calophyllum inophyllum*) with a few cocoa-nuts, Barringtonia, banyans, and other smaller trees, and an undergrowth largely consisting of immense Asplenium and other ferns and Psilotum, herbaceous dioctyledons being confined to the more open, dry, sandy, and stony parts. Mangroves and screw-pines are, curiously enough, not found. Of mammals there are now only rats and mice, but traditions of dugong remain. Birds are numerous: noddies, frigates, and terns were breeding at the time of the visit; crab-plover, curlew, whimbrel, and a sandpiper were common; and in the north-west monsoon buzzards, kites and crows are said to be regular visitors. Green and shell turtles abound, and there is also a marsh tortoise as well as geckoes. There are no amphibia. On the whole, indeed, the land flora and fauna are much what was to be expected in a group of volcanic islands.

A further communication from Mr. Stanley Gardiner, which appears in *Nature* of November 9, brings the account of the expedition down to September 12. In this letter Mr. Gardiner states that he and Mr. Cooper have had a tour round the reefs of Mauritius, and for the three weeks preceding the date of the letter had been working between this island and the Seychelles group. They find that the Mauritius reefs vary from fringing to barrier, a good example of the latter being at Grand Port, where it is four miles from the land. Here the reef has a few islets of metamorphosed coral-rock, varying up to 40 feet in height. It seemed

at first as if these might have been formed by hurricanes and blown sand, but near at hand the same rock was discovered overlying a basalt, 70 feet above the water. The islets probably therefore represent the remains of a considerable island, elevated for at least 100 feet, extending along that part of the barrier reef.

Leaving Mauritius on August 21, the party sounded and dredged off the reefs, and found the contour the same as that off atoll-reefs—that is, a gradual slope to 40 fathoms, succeeded by a steep slope to 150 fathoms, tailing off in five miles to 1000 fathoms. At 150 fathoms the bottom was covered by heavy blocks of coral from the reef above. At 300 fathoms shell and small pieces of coral were found, and further out a bottom of bare coral mud.

Between Mauritius and Cargados there is a depth of 1962 fathoms, with no marked connecting ridge. Cargados is a crescentic-shaped surface reef, 31 miles long, on the south part of the Nazareth Bank, which is roughly 220 miles long by 60 broad, with an average depth of 33 fathoms. The land is of coral rock with no signs of elevation; it is covered with guano, and yielded only 18 land plants. Land animals are scarce, but 42 insects were secured.

Near Cargados there is a wonderfully constant depth of 30 to 35 fathoms over the body of the bank, while towards its western edge there is a slight but uniform rise to 27 fathoms, this suggesting an incipient atoll. The bottom is coral rubble, white sand, shell rubble or weed.

In the channel midway between Nazareth and Saya de Malha banks a depth of 222 fathoms was got. The latter banks consist of three—a northern, a very large central, and a small south-eastern. All are of more or less atoll form.

Leaving the Saya de Malha banks the party ran a line of soundings to the narrow bank which surrounds the Seychelles, the greatest depth found being 961 fathoms. The soundings thus prove the existence of a crescentic-shaped ridge, 1100 miles long, with less than 1000 fathoms of water, arising on either side from a general depth of 2200 fathoms.

When the latter left Mr. Gardiner was at Coetivy, the most southerly island of the Seychelles group, while the ship had gone to the Seychelles for coal.

Magnetic Survey of the North Pacific.—A note in *Science* for October 6 by Dr. L. A. Bauer gives some account of the preliminary work of this survey (cf. this *Magazine*, p. 219). The brig *Galilee* of San Francisco was chartered for the purposes of the expedition, and entered upon her duties early in August. Starting from San Francisco on August 5 she sailed to San Diego on a first short experimental cruise for the purpose of testing the instruments and trying certain methods. She arrived at San Diego on August 12, when various alterations were made. A second trial cruise was subsequently made to the Hawaiian and Midway Islands, whence the vessel was expected to return on December 1. After this she is to sail early in 1906 on a lengthened cruise which will embrace the entire circuit of the Pacific Ocean.

International Oceanographical and Fisheries Exposition at Marseilles.—A representative of the French Government, M. Henri Malo, has been recently in Scotland making inquiries and obtaining information on behalf of the proposed International Oceanographical and Fisheries Exposition which is to be held in Marseilles from April to October 1906. This exposition will be the first attempt to bring into closer relation the already considerable results of scientific research and those of practical experience in these departments. The theoretical and scientific part of the exposition will comprise the work of the principal scientific societies, zoological and marine laboratories, etc., while the very remarkable work of the Prince of Monaco will occupy a large room, and France, Britain, Germany, Portugal, Norway, Sweden, Russia, America, and Japan will have separate spaces allotted to them. Following up the recent decision of the Congress of Mons (cf. this *Magazine*, p. 610) a conference of the leaders of the various Polar expeditions will be organised for the purpose of securing methodical and international co-operation in the exploration of the Polar regions; while a special section of the exposition will be devoted to the results of former Polar expeditions, in which Scotland will be represented by the work of the Scottish National Antarctic Expedition and their ship the *Scotia*. The practical and industrial side of fisheries in all parts of the world will be fully represented, as well as the products of the sea. Besides the results obtained from scientific and practical explorations in the depths of the ocean, there will be an exhibition of life-saving appliances, motor fishing-boats, wireless telegraphy, etc. During his visit to Scotland M. Malo has visited Edinburgh, Dundee, and Aberdeen, and in company with Mr. W. S. Bruce, of the *Scotia*, he spent a day at the Millport Marine Station, belonging to the Marine Biological Association of the West of Scotland. He was particularly interested in the educational side of the station's work, and it is probable that the station will contribute to the exposition, among other things, an exhibit illustrative of this work. M. Malo has been cordially received by Sir John Murray, by the officials of the Scottish Fishery Board, and by the representatives of other scientific bodies; and it is believed that a hearty response will be made to the call for a good representation of Scottish scientific work and Scottish industries at this international meeting.

Commercial Geography.

Agriculture in Costa Rica.—In the *Boletín de la Real Sociedad Geográfica*, Madrid (iii. 6), there appears an important account of this republic—important because of its bearing upon the conditions in our West Indian possessions. It appears from the account that the country has recovered from its former prostration, and, to quote the final sentence, "there is more commerce, more agriculture, and more money." As agriculture is the chief industry of the country, it is important to note the steps which the Government is taking to encourage it. The National Society of Agriculture plays an important part, in making experiments, importing useful seeds, and so forth. Again, the Secretariat of Public

Works is desirous of creating an agricultural department, with the following programme:—(1) The formation, near the capital, of a central experimental farm, on the lines of those in operation in Great Britain and the Colonies; (2) the organisation of secondary agricultural stations in the various districts under the supervision of the central establishment; and (3) of agricultural colonies in the uncultivated districts, with an agricultural station dependent on the central one; (4) the holding of periodical congresses, whose discussions and reports might afford material for national exhibitions of agriculture, to be held every four or five years; (5) to modify education so as to encourage the young to take up agriculture, and to insist that a small farm shall be attached to every rural school; (6) to popularise the experiments to be carried out by means of a magazine, to be distributed free of charge; (7) to interest the municipalities so that they may look on the encouragement of agriculture as their chief work.

The most important products of Costa Rica are coffee and bananas. While coffee rather tends to diminish, the production of bananas is increasing by leaps and bounds. In 1904 the total export value of each was 3,000,000 dollars, and out of a total of 6,000,000 bunches of bananas exported, London took 1,299,500. During this year the excess of exports over imports was about 1,700,000 dollars, so that prosperity evidently largely depends on the banana trade. Nearly one half of the total supply is produced by an energetic American Association, the United Fruit Company, and the vessels which they employ in their export trade enable them to import merchandise to such advantage that 52 per cent. of the total imports come from the United States of America. The same principle of co-operation and association would do much for the private planters, and is much wanted among the Costa Ricans.

The Foreign Trade of Siam.—The sea-borne trade of Siam appears to be increasing rapidly. Mr. Lyle, our Acting-Consul at Bangkok, in his report for the past year [Annual Series: No. 3504] says that the total value of the foreign trade there was £10,014,141, an increase of over two and a half millions beyond the previous year, and of more than two millions on 1902, which was the "record" year in Siamese trade, while it was about two and a half times greater than the total trade of 1894. The export of rice alone last year was considerably greater than the whole trade of 1894. The imports last year amounted to £4,363,966, and the exports to £5,650,175. Rice is the chief item of the export trade, and amounted to £4,520,470, or 80 per cent. of the whole, while 10 per cent. represents teak, the remaining 10 per cent. being "other products." Hong-kong and Singapore took, for distribution, over 82 per cent. of the export trade of Siam. The production and export of rice is increasing, probably on account of recent high prices and the development of the country by means of railways. India and Hong-kong are the principal customers for Siamese teak. Cotton goods and jam form the chief item of imports, and are obtained mainly from India and England. The imports of steel, iron, and machinery have doubled,

and the bulk of the supply is from the United Kingdom. It is chiefly milling machinery, iron sheets and plates, steel plates and bars, and miscellaneous steel manufactures that go from this country. Rails for the Government railways account for a great part of the increase in steel imports; 557 kilometres of line were opened to traffic at the end of March last year. An important recent measure is the law providing for the immediate extinction of many, and the eventual suppression, of all the gambling-houses of the country. By April 1907 only one or two in Bangkok will be left in all Siam. This will involve a considerable loss in revenue, but it is anticipated that this will adjust itself, and that the people will be able to contribute more to general taxation.

NEW BOOKS.

EUROPE.

Travels of a Naturalist in Northern Europe. By J. A. Harvie-Brown, F.R.S.E., F.Z.S. With Coloured Plates and other Illustrations and 4 Maps. Two volumes. London: T. Fisher Unwin, 1905. *Price* £3, 3*s.*

In these two well-illustrated volumes, Mr. J. A. Harvie-Brown gives an account of three ornithological expeditions: to Norway in 1871, Archangel in 1872, and Petchora in 1875. The natural comment upon these dates is forestalled by the author in his preface, where he frankly admits that his book may be looked upon as "cauld kail het again." No attempt has been made to bring the contents up to date, the author preferring simply to reproduce his diary in the form in which it was written down at the time. In consequence a good deal of space is taken up by accounts of meals, trifling accidents of travel, and so forth, much of which, while doubtless of interest to the party at the time, has now somewhat lost value, especially in the case of the Norwegian experiences, where the tour included what is now very familiar tourist ground. In the case of the Russian journeys, on the other hand, these minor details are, of course, of more interest, in that the ground is less familiar. Intermingled with the accounts of egg-collecting and bird-shooting the geographer will find here some interesting notes as to scenery, flora, general fauna, and the people of the regions traversed.

AFRICA.

Promenades Lointaines, Sahara, Niger, Tombouctou, Touareg. Par le Lieutenant H. Paulhiac. Paris: Librairie Plon. Plon-Nourrit et Cie., Imprimeurs-Éditeurs. *Price* 5 *francs.*

This is one of the most interesting of the many books which emanate from the well-known firm of Plon-Nourrit et Cie. in Paris, which have for their object the enlightenment of the French public with regard to the past and present conditions and the future hopes and prospects of their Colonial Empire. The writer is a lieutenant in the Colonial service, and from this, and still more from internal evidence in this book, we believe he is very young, very enthusiastic, very energetic, and somewhat impetuous. On the other hand, he certainly has used his eyes and his ears to good purpose during his sojourn in French Africa; he has

pondered much and earnestly the problems incidental to the colony, and he has formulated proposals most creditable to his heart, if not so much to his head. We doubt if they are feasible, and even if they are found to be feasible, we doubt very much if they would produce the brilliant results which he so clearly anticipates. Take, for example, his observations, trite indeed, but true and wise as to the pitiful results of the absence of roads and ordinarily good means of communication in French West Africa. It is a truism to say that no country can develop, and little if any real progress can be made in civilisation, unless, and until it is supplied with a sufficient number of judiciously placed and efficient roads. The Lieutenant elaborates this in a variety of ways, and then propounds his nostrum for good communications in French Africa. It is merely tramways on the light railway principle. He enumerates the lines which should be made, goes into great details as to how they are to be officered and maintained, and compares them triumphantly with other means of communication in respect of speed, cost, and general efficiency. Yet all the time he seems to have forgotten that the climatic conditions of the regions where these lines are to be placed render it more than doubtful if they would survive one season. The Décauville, as we know it in India and elsewhere, is a light railway with a gauge of it may be 15 or 20 inches, and although it shows excellent results when ancillary to other greater works, it is very light, and quite unfitted for rough work and permanent usage; and we believe that every time a storm of wind and rain, such as is so eloquently described by Lieutenant Paulhiac as prevalent at certain seasons of the year, passed along or over a Décauville line of rails in French Africa, it would practically wreck it and wash it away, and the part of the line so damaged would need to be relaid. Lieutenant Paulhiac has not included in his calculations periodical repairs and renewals of the line, nor has he sufficiently taken into consideration the continual and irritating delays and losses to traders using the line, which the climatic conditions of the country render inevitable.

Lieutenant Paulhiac was evidently deeply impressed with the ignorance and laziness of the more peaceful members of the population (the fiercer and practically unconquered tribes, like the Maures and the Tawareks, he considers unmanageable for the present), and seeing that they have practically only one means of livelihood, viz. agriculture and stock-breeding, he propounds the theory that it is the urgent and obvious duty of the Government to educate the people in these arts. This may for the moment be admitted, but when he comes to indicate the way in which Government should set about educating the millions dependent on agriculture, he again shows signs of not having thoroughly thought out his subject. Warned but undeterred by the wretched results of the Government schools at Senegal and Cayor, he proposes to institute in each region what we would call a Normal School of Agriculture alone, which schools he asserts would cost little or nothing to the state, and would send forth thoroughly trained professors of agriculture into the villages of the regions to which they belonged. The pupils in these Normal Schools would not be the sons of chiefs, because the experience of the Senegal and Cayor schools has shown that they are not a success, looked at from any point of view, but the sons of freemen, or even of slaves, if their intelligence and activity marked them out as likely students or budding professors. The sons of peace-loving Bambaras and Peuls would be taken; the sons of fierce Tawareks and Maures would be excluded. A course of five or six years' instruction in the case of those who did not know French, and of two or three years in the case of those who knew French, would, he thought, be sufficient to train them into being teachers of others. At each Normal School there would be two French professors trained in agriculture and stock-farming, who would, in addition to these arts,

teach to the young Bambaras and Peuls "des éléments très primitifs de travaux d'art; menuiserie, charpenterie, briquaterie, etc., des éléments de médecine pratique et rudimentaire, afin de pouvoir appliquer les traitements de thérapeutique destinés à combattre les maladies, les plus généralement répandues." Now when we remember that, according to Lieutenant Paulhiac's own account, the people with whom he has to deal are as backward as any in Africa, it is easy to see that the proposals above cited, however excellent in theory, are thoroughly impracticable and unworkable.

It would do Lieutenant Paulhiac a lot of good, and would open his eyes to much that is now hidden from him, if he would spend a year or two in British India and examine what has been tried there successfully, and still more unsuccessfully, to provide agricultural and elementary education among races quite as peaceful and much more advanced than the Bambaras and Peuls of West Africa. In India he would find a powerfully manned and energetic Department of Agriculture, the officers of which would willingly put all their experience at his disposal. But, unfortunately, this is probably the very last thing Lieutenant Paulhiac would consent to do, for it is very evident, from passages in this book, that he cordially detests and distrusts the English as well as the Germans. We regret this very much, because French Africa, in its present backward condition, needs the enlightened services of every good Frenchman it can command, and more especially of such men as the writer of this book—young, brave, sympathetic, enthusiastic, able and energetic, although impetuous, rash, and over-confident as to results.

AMERICA.

Geografía de la Provincia de Córdoba. Por MANUEL E. RÍO y LUIS ACHÁVAL, ingenieros civiles, etc. Escrita por encargo del Excmo. Gobierno de la Provincia. Publicación Official. Buenos Ayres, 1904.

Córdoba lies in the heart of the Argentine Republic. "The Province of Córdoba, one of the fourteen which form the Argentine Republic, is situated in the central part of the vast South American region which embraces this country, being contained between 29° 30′ and 35° south latitude and 61° 47′ and 65° 46′ 53″·5 of west longitude from Greenwich. By its situation, it is purely inland, the most easterly point of its frontier being 84 leagues from the Atlantic, and the western 104 from the Pacific. Geographically considered, it lies entirely within the temperate zone . . ." etc.

The book which lies before us, consisting of two large volumes and a most excellent and comprehensive atlas, is in the form of an Encyclopædia, and is an official publication, carrying government authority. The various articles, which are really treatises, are written by experts, and we may at once say that the authors not only seem to know their subjects but to be lovers of their country, who are desirous that others should think well of it. It is no mere Blue Book of dry statistics, but a very readable work, full of information, criticising where necessary, and giving many valuable suggestions. All who are interested in the Argentine should study this work, and we venture to think that in such countries as Germany it will be translated into the vernacular.

The Province of Córdoba owes its peculiarities and advantages of climate to its conformation. The chief geographical feature is the range of mountains, called the Sierras de Córdoba, consisting of three parallel ranges, running north and south, with extensive valleys between. These alternate mountains and valleys help to produce oscillations in temperature, rain and wind; they give an exhilaration to

the atmosphere which both conduces to health and lends vigour and energy to the inhabitants. The climate may be termed sub-tropical, its European representatives being the southern parts of Spain, Italy, and Greece; only, from its inland position, there are greater variations of rainfall and temperature, and less humidity. Hygrometrically speaking, the climate may be called dry, the humidity ranging between 60 and 63 per cent., the sky is clear, cloudy days being only 60 to 70 in the year. The direct sunlight reaches 62 per cent. In this respect it compares favourably with the European regions referred to.

The rainfall is equal to that of Central Europe, about 690 mm., with, however, this drawback, that while 60 cm. fall between October and March, only 9 cm. fall in the rest of the year. This leads to one of the most important chapters, that on "Irrigation." Most of the rivers which rise in the Sierras do not reach the sea, but as soon as they come to the level spread out and are lost in the depths of the soil, rising again to the surface later in the form of fens and marshes. In short, they are wasted, not entirely but to a great extent. The districts beyond, where the water comes again to the surface, are capable of raising crops even in the dryest seasons, and are so far independent, but the intermediate land is subject to severe and disastrous droughts. Now, it is obvious that the formation of the Sierras, with the enclosed valleys, each cut up again into sections by buttresses, lends itself to the making of Catchment Areas. And this is rendered more easy by the outlets, which are deep, narrow fissures. One of these valleys, just above the capital, has already been hemmed in by a dam, called the dyke of San Roque, and it is claimed that it encloses the largest reservoir in the world. There is an excellent photograph of the lake and the dam in the atlas, showing the narrowness of the gorge. There are many other valleys of equal suitability, and the Argentine engineers are busy weaving schemes for the formation of other huge reservoirs in the watershed areas of the Rio Segundo and Rio Tercero. This subject merits very close study, as it means so much for the future both of agriculture and of cattle farming.

The most important industries are those of agriculture and cattle breeding, and there are not wanting very exhaustive chapters on these subjects.

Agriculture includes cereals, such as wheat and maize, and forage, the principal being alfalfa, or lucerne grass. With regard to wheat, attention is drawn not only to the great progress made of late years, but also to the defects in quality owing to careless sowing and threshing. Reference to the map will show that the growth of cereals and alfalfa tend to run parallel with the lines of railway, to a distance of 10 to 30 miles on either side, and that the more distant districts are occupied by cattle-rearing farms.

The section dealing with horses and cattle is very detailed and instructive. One is reminded how in 1537 Pedro de Mendoza abandoned a few horses of Andalusian breed, and how these found the country so good to live in that they bred in enormous numbers, and became the parents of the present hardy stock. The breeding of cattle depends largely on the production of forage, and that again on the continuous water supply.

One industry which is much neglected is arboriculture. Owing to neglect and waste the area of forests is diminishing year by year, and attention to this subject is earnestly asked for by the writers.

It is impossible to take note of all the details of this very interesting book, but one must not fail to mention the great and rapidly increasing manufacturing industries. Córdoba, which is twice the size of Portugal, has a population of only 450,000, and we are assured that the country is capable of holding several millions in health and comfort.

The atlas to which we have alluded contains not only maps of the usual kind, but pictures of some of the flowers of the country, and some very good photographs illustrating the text. The chapter on the flora and the pages on the medicinal plants should be of interest to botanists and pharmacologists.

Panama. Edited by Edward James Cattell. Foreign Commercial Guide. Published by the Philadelphia Commercial Museum, 1905. Pp. 17, with Map.

This little pamphlet may be cordially recommended as giving in compact form an enormous amount of information about the Republic of Panama. While professedly compiled primarily for commercial purposes, it contains a large amount of purely geographical matter, and is a model of what a brief monograph on a country ought to be.

The republic of Panama is a region of great natural interest, and one which may be expected to undergo rapid development in the near future. Meantime, with an area of 31,571 square miles, it only supports a population of 311,000. As the monograph before us points out, the area has had at various times periods of great prosperity, but these have been mostly temporary, and have been due to outside enterprise and not to the initiative of the people themselves. The great drawback in the way of permanent development of the country has been the lack of facilities for transport. Comparing it, for example, with the state of Massachusetts, we find that the latter state, with an area only one quarter of that of Panama, has over 2200 miles of rail as against 50 miles in Panama. Nor is the poverty in railroads made up for by good roads, for those in Panama are poor in the extreme. The editor of the report is of the opinion that the canal concession granted to the United States will be of great importance for the development of the country, for it will strengthen foreign confidence in the local administration sufficiently to allow of the flow of capital from the great centres of the world, and such a flow of capital would soon solve the transportation problem.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course :—

A Historical Geography of the British Colonies. Vol. II.: The West Indies. By C. P. Lucas, C.B. Revised and brought up to date by C. Atchley, I.S.C. Crown 8vo. Pp. iv + 348. *Price 7s. 6d.* Oxford : Clarendon Press, 1905.

The Siege of the South Pole : The Story of Antarctic Exploration. By Hugh Robert Mill, LL.D., D.Sc. With maps, diagrams, and other illustrations, and maps by J. G. Bartholomew. Demy 8vo. Pp. xvi + 455. *Price 7s. 6d. net.* London : Alston Rivers, 1905.

A Yankee in Pigmy Land. By William Edgar Geil. Crown 8vo. Pp. xii + 409. *Price 6s.* London : Hodder and Stoughton, 1905.

Place-Names of Ross and Cromarty. By W. J. Watson. Demy 8vo. Pp. lxxxvi + 302. Inverness : The Northern Counties Printing and Publishing Co., Ltd., 1904.

Jungle Trails and Jungle People: Travels, Adventures, and Observation in the Far East. By Caspar Whitney. Crown 8vo. Pp. xv + 310. *Price 12s. net.* London : T. Werner Laurie, 1905.

Notes from my South Sea Log. By Louis Becke. Crown 8vo. Pp. vi + 352. *Price 6s. net.* London : T. Werner Laurie, 1905.

History of India. By C. F. de la Fosse., M.A. Crown 8vo. Pp. 302. *Price* 2*s.* 6*d.* London: Macmillan and Co., Ltd., 1905.

The Guide to South Africa, for the use of Tourists, Sportsmen, Invalids, and Settlers. By A. Samler Brown and G. Gordon Brown. With coloured maps, plans, and diagrams. 1905-1906 edition. Crown 8vo. Pp. lxiv + 477. *Price* 2*s.* 6*d.* London: Sampson Low, Marston and Co., 1905.

Canada in the Twentieth Century. By A. G. Bradley. Demy 8vo. 5*s. net.* London: A. Constable and Co., Ltd., 1905.

Leitfaden der Handelsgeographie. Von Dr. Max Eckert. Demy 8vo. Pp. 248. *Preis* 3*m.* Leipzig: G. J. Göschen, 1905.

Also the following Reports:—

Military Report of the Provinces of Shensi and Kansu (Shen-Kan). Compiled in the Intelligence Branch, Quartermaster-General's Department. Simla, 1905.

Report on the Administration of the Meteorological Department of the Government of India in 1904-1905. Calcutta, 1905.

Report of the Danish Biological Station to the Board of Agriculture, 1902-1903. By C. G. J. Petersen, Ph.D. Copenhagen, 1905.

British New Guinea: Annual Report for the year ending 30th June 1904. Melbourne, 1904.

The Topography and Geology of the Fayum Province of Egypt. By H. J. L. Beadnell, F.G.S., F.R.G.S. Cairo, 1905.

Publishers forwarding books for review will greatly oblige by marking the **price** *in clear figures, especially in the case of foreign books.*

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

A Meeting of Council was held on the 10th November, when the undermentioned ladies and gentlemen were elected Members of the Society:—

Andrew Lee, M.A.
Miss Marshall.
Sir R. Waldie Griffith, Bart.
Arthur W. Beddow.
Wm Crocket.
Rev. Jas. Gillan.
Wm. Inman.
Wm. Croft Gray.
Alex. Brymner.
Miss Grace Meiklejohn.
John Robertson.
Miss Ivy Younger.
John L. Forrest.
Miss Agnes Bain.
Miss Stewart.
Miss M. S. Somerville.
Geo. Alfred Hake.
Mrs. Ewing.
Rev. Geo. Robson, D.D.
Miss Jameson.
W. Bertram Miller.
Miss Margt. K. Gray.
Mrs. Archibald Forbes.
Wm. Lang.
John B. Wilson.
George W. S. Clark.
Wm. Thomson, Junr.
Peter MacKichan.
John Paterson.
James A. Wilkie.
Alexr. Hutcheon.
Alexr. Frisken.
Jas. Bow.
J. H. Ballantyne.
Robt. S. Sloan.
Alexander A. Spiers.
Jas. A. Findlay.
Geo. Herbert.
John Houston.
A. H. Donald.
Alexr. Walker.
J. A. Black.
Robert Lyle.
Andrew M. Smith.
Peter Smith.
Chas. Soutar.
Dr. George Bryce.
Harry Tulloch.
Dr. E. M. Modi, M.S.C.I., M.S.A.
Miss Harriet Cotterell.
Mrs. Cossar.
Miss Ella Gibson.
J. Denholm.

The Annual Business Meeting.

The Annual Business Meeting was held on the 10th November, in the Library of the Scottish Society of Antiquaries, by kind permission—Professor James Geikie, D.C.L., LL.D., F.R.S.S.L. and E., President of the Society, in the Chair.

The Chairman, in moving the adoption of the Report, said that he thought that the members of the Society would agree that, during its twenty-one years of existence, the Society had done fairly well, though not so well that they could afford to rest upon their laurels. They must make a still greater advance. During the year they had lost some old friends and valued members of the Society by death, but new members were still increasing, and efforts must be made to keep up the membership of the Society.

Major W. Lachlan Forbes, the Secretary, who succeeded Lieutenant E. H. Shackleton on the latter's resignation of the post, then read the Twenty-first Annual Report of the Council, which stated that during the year 409 new members had been added, and that the membership had increased from 1464 to 1790. On that day the Council had elected 53 new Ordinary Members. Thirty-five Ordinary Meetings were held during the session—10 in Edinburgh, 11 in Glasgow, 7 in Dundee, and 7 in Aberdeen, and the number of persons attending the lectures was approximately 36,000, being an increase of 21,000 over the previous session.

The Vice-Presidents were re-elected, and the Earl of Dalkeith, M.P., and Lieutenant-Colonel Lord Saltoun proposed for the office of Vice-President in place of the late Lord Kinross and the late Viscount Melville, whose deaths the Society has to deplore. This proposal was moved by the President, seconded by Dr. Horne, and unanimously carried.

The following members of Council who retired by rotation were re-elected:—Dr. Maurice Paterson, Dr. D. F. Lowe, Colonel Wardlaw Ramsay, Mr. W. B. Blaikie, Dr. George Smith, C.I.E., Captain D. Livingstone Bruce, Colonel T. Cadell, V.C., and Brigade-Surgeon Lieutenant-Colonel James Arnott.

The following members of the Society were elected to fill vacancies on the Council:—Mr. Henry A. R. Chancellor, Mr. J. J. Dobbie, M.A., D.Sc., Captain Alan Foster, Mr. John Geddie, Principal Laurie, and Lieutenant E. H. Shackleton.

Dr. Paul Rottenburg was elected Chairman of the Glasgow Centre, in room of Mr. W. F. G. Anderson, who has resigned. The Chairmen of the Aberdeen and Dundee Centres were re-elected.

The Annual Report was then put to the Meeting by the Chairman, and unanimously adopted.

Mr. James Currie, Hon. Treasurer, then submitted the financial report, which showed that the income from the members' subscriptions had largely increased, and that, though there had been abnormal expenditure under several heads, the balance at the bank was £80 more than it was a year ago. Comparing the position of the Society with

that of ten years ago, the Treasurer showed that receipts for membership and for lecture tickets had largely increased. That this had taken place in spite of the fact that the large increase of members—mainly due to the efforts of Lieutenant E. H. Shackleton, the former Secretary—might be regarded as tending to deplete the number of non-members interested in geographical science. It was to be hoped, he continued, that among the purchasers of tickets good seed had fallen, which would yield a rich harvest of members in future.

The financial report was unanimously adopted.

It was intimated by the Hon. Secretary that the Livingstone Medal for 1905 had been awarded to Sir Archibald Geikie, D.C.L., LL.D., F.R.S., in recognition of his distinguished contributions to Geographical Science, notably the Physical Geography of Scotland; and that Silver Medals had been awarded to Mr. Robert C. Mossman for his valuable scientific services as a member of the Scottish National Antarctic Expedition; to Major C. H. D. Ryder, R.E., for his explorations in Western Tibet; and to Major A. St. Hill Gibbons for his explorations in Central and South Africa.

The Secretary then read the programme of lectures for the forthcoming session, which was received with applause.

Votes of thanks to the Society of Antiquaries for the use of their Library for the Meeting, and to the President, were passed.

The Meeting then terminated.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

REPORT OF COUNCIL.

Twenty-first Session, 1904-1905.

The Council has the honour to submit the following Report:—

Membership.

The changes which occurred during the Session in the number of members were as follows:—

Number on 1st November 1904,		1464
New members added,		409
		1873
Deduct by Death,	37	
„ Resignation,	46	
		83
Number remaining on Roll on 31st October 1905,		1790

Of this number, 1045 are on the Edinburgh list, 369 are on the Glasgow list, 148 and 92 are on the Dundee and Aberdeen lists respectively. In addition to those on the lists named, 40 members reside abroad, and 96 reside in England. Of the total number of 1790 members, 269 are life members.

Changes in Office-Bearers.

At the conclusion of his term of office as President, Sir John Murray, K.C.B., LL.D., F.R.S., retired, and received the cordial thanks of the Society. Professor James Geikie, D.C.L., LL.D., F.R.S., was at the opening of the past session elected President in his stead. Lieut. E. H. Shackleton having resigned office as Secretary and Treasurer of the Society at the close of the past session, was heartily thanked for his services, and in his room Major W. Lachlan Forbes, late 7th Royal Fusiliers, was appointed Secretary and Treasurer of the Society.

Twentieth Anniversary Banquet.

To commemorate the Twentieth Anniversary of the Society, a Banquet was held on 12th November 1904 in the North British Station Hotel, Edinburgh. Sir Clements Markham, K.C.B., President of the Royal Geographical Society of London, and Captain R. F. Scott, R.N., C.V.O., Commander of the National Antarctic Expedition, were the principal guests. Mr. W. S. Bruce, leader of the Scottish National Antarctic Expedition, was also to have been one of the principal guests, but was prevented by illness from being present. One hundred and twenty-one members of the Society attended the Banquet.

Meetings.

The Society's Anniversary Meeting was addressed by Captain R. F. Scott, R.N. Thirty-five ordinary Meetings were held, ten of them in Edinburgh, eleven in Glasgow, seven in Dundee, and seven in Aberdeen. These meetings were addressed by Captain R. F. Scott, R.N., Mr. Rudmose Brown on behalf of Mr. W. S. Bruce, leader of the Scottish Antarctic Expedition, Colonel Sir Francis Younghusband, Mr. Arthur Hill, Mr. W. Eagle Clark, Mr. S. L. Bensusan, Rev. W. H. Abbot, Mr. Douglas Freshfield, Mr. S. Turner, Dr. Tempest Anderson, Mr. W. E. Geil, and Captain Voss.

Medals Awarded.

The Society's Gold Medal for 1904 was presented by Sir John Murray, K.C.B., as President, to Mr. W. S. Bruce, as leader of the Scottish National Antarctic Expedition on the *Scotia* reaching Millport on her return from the Antarctic, and a large number of members of the Society attended the Luncheon which was then given to Mr. Bruce and his staff.

The Livingstone Gold Medal of the Society for 1904 was presented by Professor James Geikie, as President, to Captain R. F. Scott, R.N., C.V.O., Commander of the National Antarctic Expedition, when he addressed the Society on the results of that expedition.

The Society's Silver Medal for 1904 was presented to Captain Thomas Robertson, captain of the *Scotia*.

The Society's Bronze Medals for 1904 were presented to the following members of Mr. Bruce's scientific staff, viz.: Mr. D. W. Wilton; Mr. R. N. Rudmose Brown, B.Sc.; Dr. J. H. Harvey Pirie, B.Sc., M.B.; Mr. W. A. Cuthbertson, and Mr. Alastair Ross.

Attendances.

During the past Session the number of persons attending the lectures was approximately 36,000, being an increase of 21,000 over the previous Session.

Finance.

The Council begs to submit the Annual Financial Statement.

ABSTRACT OF THE ACCOUNTS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

From 31st October 1904 to 31st October 1905.

FUNDS AT THE CLOSE OF LAST ACCOUNT :—			
£1000 Glasgow and South-Western Railway Company 4 per cent. Funded Debt, at cost price, as at 29th May 1885,		£1102 19 9	
£533, 6s. 8d. North British Railway Company 3 per cent. Consolidated Lien Stock, at cost price, as at 30th December 1890,		496 2 0	
£200 Great Central Railway 4½ per cent. Debenture Stock, at cost price, as at 31st December 1898,		312 2 9	
£240 North British Railway Company 4 per cent. Consolidated Preference Stock, at cost price, as at 11th December 1902,		306 8 9	
		£2217 13 3	
BALANCES due by Bank of Scotland—			
1. On Account Current,	£187 16 10		
2. On Deposit Receipt,	104 19 5		
3. Do. do., Equipment Fund (Glasgow)	54 17 10		
		347 14 1	
BALANCE due by Secretary,		1 1 0	
		£2566 8 4	
BALANCE due to Livingstone Fund,		12 19 8	
		£2553 8 8	
SUBSCRIPTIONS from Ordinary Members,	£1537 4 0		
Do. do. Life Members,	145 0 0		
FEES received for Society's Diploma,	3 3 0		
DIVIDENDS and INTEREST,	78 13 1		
		1764 0 1	
		£4317 8 9	

MAGAZINE—Expenses of Publication, etc., from Nos. 10 to 12 of Vol. XX., and Nos. 1 to 9 of Vol. XXI. :—			
Printing and other charges,			£554 10 10
Illustrations			49 0 4
Maps,			37 2 6
			£640 13 8
Less—			
Magazines sold,	£59 6 7		
Advertising Receipts, less Payments,	172 19 10		
		232 6 5	
		£408 7 3	
GENERAL PRINTING,			92 11 4
BOOKS and other furnishings for Library,			20 13 2
RENTS OF HALL, and other expenses of Lectures,	£947 19 11		
Less Lecture Tickets sold,	462 14 2		
		485 5 9	
GLASGOW BRANCH, Rent of Hall,			25 0 0
RENT OF COUNCIL ROOM, Taxes, Gas, Repairs, Insurance, etc.,			134 2 1
ADVERTISING,			14 14 0
SALARIES,			363 6 8
MISCELLANEOUS, including Stationery, General Expenses, Postages, and expense of Society's Guests at Banquet, etc.,			118 10 3
MEDALS,			17 5 6
			£1679 16 0
FUNDS AT CLOSE OF THIS ACCOUNT :—			
£1000 Glasgow and South-Western Railway Company 4 per cent. Funded Debt, at cost price, as at 29th May 1885,		£1102 19 9	
£533, 6s. 8d. North British Railway Company 3 per cent. Consolidated Lien Stock, at cost price, as at 30th December 1890,		496 2 0	
£200 Great Central Railway 4½ per cent. Debenture Stock, at cost price, as at 31st December 1898,		312 2 9	
£240 North British Railway Company 4 per cent. Consolidated Preference Stock, at cost price, as at 11th December 1902,		306 8 9	
		£2217 13 3	
BALANCE due by the Bank of Scotland :—			
1. On Account Current,	£355 11 6		
2. On Deposit Receipt,	4 19 5		
3. On do. do. (Glasgow Equipment Fund),	54 17 10		
		415 8 9	
BALANCE due by Secretary,		32 2 7	
		2665 4 7	
BALANCE due to Livingstone Fund,		27 11 10	
			2637 12 9
			£4317 8 9

Edinburgh, 10th November 1905.—We have examined the Accounts of the Royal Scottish Geographical Society for the year ending 31st October 1904, of which the

LIVINGSTONE MEDAL FUND.

FUNDS AT CLOSE OF LAST ACCOUNT:—						
£770 North British Railway Company 4 per cent. Preference Stock No. 1, at cost price,				£999	11	6
Sum on Deposit Receipt with the Bank of Scotland, Greenside Branch,				14	13	11
				£1014	5	5
Balance due by General Fund,				12	19	8
				£1027	5	1
Income received—						
1. Dividend on £770 North British Railway Company 4 per cent. Preference Stock No. 1—						
For half-year to 31st January 1904, £15, 8s., less tax,	£14	12	8			
For half-year to 31st July 1905, £15, 8s., less tax,	14	12	8			
	£29	5	4			
2. Interest on Deposit Receipts uplifted.	0	8	11			
				29	14	3
				£1056	9	4

Paid Messrs. Alex. Kirkwood and Sons for Medal,						£29 16
Funds at close of this Account—						
£770 North British Railway Company 4 per cent. Preference Stock No. 1, at cost price,				£999	11 6	
Balance due by General Fund,				27	11 10	
						1027 3 4
						£1056 9 4

Edinburgh, 10th November 1905.—Examined and found correct.—MACANDREW & BLAIR, C.A.

The Society's Magazine.

The Scottish Geographical Magazine has, as usual, been published monthly throughout the past Session, with maps and illustrations.

The Council is glad to acknowledge its obligation to the contributors of articles, and to the following gentlemen who have rendered valuable assistance to the Editors:—Hon. J. Abercromby, J. G. Bartholomew, H. M. Cadell, Dr. A. S. Cumming, Dr. R. W. Felkin, H. B. Finlay, Professor Patrick Geddes, J. T. P. Heatley, Dr. A. J. Herbertson, Professor C. G. Knott, H. Brantwood Muff, Ralph Richardson, Kenneth Sanderson, Colonel J. Sconce, C. W. A. Tait, W. A. Taylor, W. B. Wilson.

Library and Map Department.

During the past Session 148 books, 47 pamphlets, 93 reports, 10 atlases, 254 map-sheets and charts have been added to the Library. The number of volumes borrowed by members was 1033; and the Library was, as usual, much consulted by non-members in search of geographical information.

The Council desires to record its thanks to foreign and colonial Governments for the official publications they have presented to the Library, and also to the undermentioned private donors of books and maps, viz.:—Mrs. Currie, Mrs. Wilson, A. F. Stewart, Dr. M. A. Stein, Nelson Annandale, Alex. Macdonald, F.R.G.S., Samuel Turner, F.R.G.S., Arch. Little, Joseph Joubert, Carsten E. Borchgrevink.

The Council also begs to thank Mr. J. G. Bartholomew for a series of maps which he has presented to the Society, illustrative of the Congo territory.

The Council has again the pleasure to acknowledge the services rendered by the honorary officials of the Glasgow, Dundee, and Aberdeen Centres, and begs specially to thank Messers. R. W. K. Bain, A. Crosbie Turner, and David Wylie, for their continued successful conduct of the business of the Society.

INDEX: VOL. XXI.

In the following Index the ALPHABETICAL ORDER *is adhered to throughout. Titles of Papers are in deeper type. Contractions,* rev.= *Review in the Magazine.*

ABBOT, Brig.-Gen. Henry L., Problems of the Panama Canal, 399; *rev.*, 508.
—— Rev. W. H., Lectures by, 152.
Aberfeldy, The Geology of the Country round Blair Atholl, Pitlochry, and Braes of Rannoch, Tyndrum, Killin, Ben Lawers, Glen Lyon, Glen Dochart, Glen Lochay, Glen Tarken, Glen Quaich, Glen Almond, Glen Turret, Glen Farg, Glen Ogle, Glen Artney, Glen Buckie, Glen Barrow, Wilson and Craig, 456.
Abyssinia, Macmillan Expedition to, 214.
—— and the Sudan, Establishment of a Commercial River Route between, 214.
Abyssinian Boundary in East Africa, The Proposed Anglo-. By S. H. F. Capenny, 260.
Achanalt, Loch, Survey of, 469
Achaval, Manuel E. Ria y Luis, Geografia de la Provincia de Cordoba, 568; *rev.*, 671.
Achilty, Loch, Survey of, 473.
Adirondacks, Physiography of the, 558.
Ægyptische Sudân, Erythräa und der, (Schoenfeld), 54.
Africa (Bailey), *rev.*, 343.
—— In Unknown (Powell-Cotton), 343: *rev.*, 452.
—— New Rainfall Map of, 649.
—— Prof. Karl Dove on the Economic Future of, 161.
—— Yule Oldham on the Unveiling of, 645.
—— British East, M'Millan Expedition to, 607.
—— Central, Cultivation of Rubber in, 450.
—— —— Mineral Resources of, 450.
—— —— **The Anglo-Portuguese Boundary in. By S. H. F. Capenny, 440.**
—— East, Development of, 213.
—— —— **The Proposed Anglo-Abyssinian Boundary in. By S. H. F. Capenny, 260.**
—— **south of the Limpopo, Geographical Notes on. By F. S. Watermeyer, 625.**
—— South, A. W. Rogers on Glacier Periods in, 644.
—— —— Cartography of, 625.
—— —— Climatology of, 646.
—— —— Dr. Haddon on the Peoples of, 644.
—— —— E. Hutchins on the Indigenous Forests of, 645.
Africa, South, Physical Features of, 634.
—— —— Population of, 629.
African Fresh-Water Fishes, Distribution of, 644.
Agassiz, Professor A., on his Expedition to the Eastern Pacific Ocean, 392.
Agra and Oudh, District Gazetteer of the United Provinces of, Nevill, 171.
Ainsworth, W. F., Travels and Researches in Asia Minor, Mesopotamia, and Armenia, 228.
Alaska, Coal Deposits in, 107.
—— Glaciers and Glaciation (Harriman), *rev.*, 226.
Alexander-Gosling Expedition, The, 385, 599.
—— Captain Claud, Death of, 100, 214.
—— Lieut. Boyd, Expedition to Northern Nigeria, 100, 214.
Alpen, Neue Karten und Reliefs der (Penck), 400.
Altai Mountains, Exploration in the, 652.
America (Kelly), *rev.*, 343.
—— Glaciation in North, 104.
—— The Kohl Collection of Maps relating to (Winsor), 286.
—— South, Baron Erland Nordenskjold's Expedition to, 662.
American Ethnology, Report of the Bureau of, 286.
Amundsen, Captain R., Expedition to the Magnetic Pole, 156, 393, 664.
Andaman and Nicobar Islands, the (Temple), 286.
Anderson, Dr. Tempest, Lectures by, 210.
—— **Tempest, M.B., D.Sc., Recent Changes in the Crater of Stromboli. 345.**
Andersson, Dr. J. Gunnar, and Dr. Otto Nordenskjöld, Antarctica: or, Two Years among the Ice of the South Pole, *rev.*, 315.
Andes, Flora of High, 256.
—— La Cordillera de los (Patron), *rev.*, 565.
Anglo-Abyssinian Boundary in East Africa, The Proposed. By S. H. F. Capenny, 260.

Anglo-Portuguese Boundary in Central Africa, The. By S. H. F. Capenny, 440.
Annandale, Nelson, The Faroes and Iceland, 456; *rev.*, 615.
Antarctic Continent, Captain F. W. Hutton on a former extensive, 559.
—— —— Relation of the Chatham Islands to the, 409.
—— —— Sir Clements Markham on the probable shape of the, 376.
—— Expedition, *Discovery*, Exhibition of Pictures and Photographs, 105.
—— —— —— New genus of Pelagic Algæ, 158.
—— —— **The French, 463.**
—— —— —— Arrival at Puerto Madryn, 217.
—— —— —— Members awarded the Crosses of the Légion d'Honneur, 449.
—— —— **Scottish National. By William S. Bruce, 322.**
—— —— —— **Second Antarctic Expedition: Voyage of the *Scotia*. By J. H. Harvey Pirie, B.Sc., M.D., and R. N. Rudmose Brown, B.Sc., 24.**
—— —— —— Continuance of the Meteorological Station at Scotia Bay by the Argentine Government, 48.
—— —— —— Current Observations, 336.
—— —— —— Relief of the Meteorological Party at the South Orkneys, 48.
—— —— **Some Results of the Scottish National. By William S. Bruce, 401.**
—— —— **The Scientific Results of the National, 318.**
—— —— L. C. Bernacchi on the work of the National, 643.
—— Exploration, Henryk Arctowski on International, 663.
—— Mr. Ferrar on the Physical Geography of the, 320.
—— Meteorology, H. Arctowski on, 47.
—— **Problem, The, 376.**
—— Sea-ice, Captain Colbeck on, 320.
—— **Station, Argentine. By R. N. Rudmose Brown, B.Sc., 207.**
—— —— Argentine Meteorological, Mr. Mossman on the First Year's Work of the, 207.
—— —— Argentine, 331.
Antarctica, 315.
—— (Nordenskjöld), 227.
—— or, Two Years among the Ice of the South Pole (Nordenskjöld), *rev.*, 315.
Aparri to Manila, Proposed Railway from, 159.
Arctic, Duke of Orleans' Expedition to the, 610.
—— Expedition, Captain R. Amundsen's, 393, 664.
—— —— Mylius Erichsen's proposed, 609.
—— —— The Mylius Erichsen, 663.
—— —— A. H. Harrison's proposed, 609.
Arctic Expedition, Duc d'Orléans' new, 333.
—— —— Einar Mikkelsen's proposed, 608.
—— —— Lieut. Peary's, 610.
—— —— Lieut. Peary's new, 157, 332.
—— —— Peary, Departure of the *Roosevelt*, 502.
—— —— Relief of the Ziegler, 157.
—— —— Wilson's proposed, 610.
—— —— Ziegler, Arrival of the Relief Ship of the, at Tromsoe, 543.
—— Region, The Improbability of Land in the Vicinity of the North Pole, 273.
Arctowski, H., on Antarctic Meteorology, 47.
—— Henryk, on International Antarctic Exploration, 663.
Argentina, Agriculture in, 160.
—— La Repubblica (Colombo), *rev.*, 620.
—— Railways in, 160.
Argentine Antarctic Meteorological Station, R. C. Mossman on the First Year's Work of the, 207.
—— —— **Station. By R. N. Rudmose Brown, B.Sc., 207.**
—— —— —— Mr. Mossman on the, 331.
—— Government and the Continuance of the Scottish National Antarctic Expedition's Meteorological Station at Scotia Bay, 48.
—— —— and the Meteorological and Magnetical Observatory at the South Orkneys, 24.
Arizona, the Underground Waters of the Gila Valley, 101.
Arkansas, Sunk Lands of Missouri and, 390.
Armenians, Characteristics of the, 367.
Asia (Wallis), *rev.*, 343.
—— Central, Dr. Sven Hedin's New Expedition, 660.
—— —— French Expedition to, 660.
Asia Minor, Mesopotamia, and Armenia, Travels and Researches in (Ainsworth), 228.
—— —— Pontus, and Armenia, Researches in (Hamilton), 228.
—— —— Travels in Little-Known Parts of (Lennep), 228.
Asie Mineure, Description Physique (Tchihatoheff), 228.
Assam, Report of the Province of, 344.
—— Upper, Geology of, 557.
Assuan Reservoir and Lake Moeris, The (Willcocks), *rev.*, 225.
Atlantic Ocean and Weddell Sea, Bathymetrical Survey of the South. By William S. Bruce, 402.
—— —— **Deep-Sea Deposits of the South. By J. H. Harvey Pirie, B.Sc., M.B., 413.**
Aucher-Eloy, Relations de Voyages en Orient, 228.
Australasia (Glover), 568; *rev.*, 343.
Australia and New Zealand, A Statistical Account of, *rev.*, 114.
—— —— —— (Coghlan), 286.

Australia and Tasmania, Nests and Eggs of Birds found breeding in (North), 116.
—— The Calvert Scientific Exploring Expedition (Hill), 456; *rev.*, 509.
—— The Native Tribes of South-East (Howitt), 54, 165.
—— W. Lindgren on the Snowy Range, 501.
—— South, Results of the Barclay-Macpherson Expedition to Lake Eyre, 500.
Australian Year-Book, Western (Fraser), *rev.*, 114.
—— Aboriginals, Origin of the, 217.
Azara, Felix de, Geografia Fisica y Esferica de las Provincias del Paraguay y Missiones Guaranies, *rev.*, 280.

Baedeker, Karl, Belgium and Holland, 285; *rev.*, 337.
—— —— Greece, 344; *rev.*, 564.
—— —— Konstantinopel und das Westliche Kleinasien, 344; *rev.*, 564.
—— —— Switzerland, 456; *rev.*, 564.
Bahama Islands, Geology and Flora of the, 557.
Bahr-el-Ghazal, Climate of, 661.
Baikal, Lake, Area of, 43; Fauna of, 44.
Bailey, C. M., Africa, *rev.*, 343.
Bain, R. Nisbet, Scandinavia, 171; *rev.*, 277.
Balfour, Dr., on Malaria in the Sudan, 99.
Bandar Sudan, New Sudan Port, 156.
Bandelier, A. F., The Basin of Lake Taticaca. 582.
Banks, Sir Joseph, Illustrations of the Botany of Captain Cook's Voyage Round the World, 344.
Barclay, Captain, on the Results of his Expedition to Lake Eyre, South Australia, 500.
Barotseland, Colonel Harding in Remotest. By S. H. F. Capenny, 484.
—— In Remotest (Harding), 456; *rev.*, 484.
Barrett, Robert L., Expedition to Turkestan, 155.
Barrow, G., The Geology of the Country Round Blair Atholl, Pitlochry, and Aberfeldy, 456.
—— —— Memoirs of the Geological Survey (Scotland), *rev.*, 617.
Bartholomew, J. G., Royal Geographical Society's Victoria Research Medal awarded to, 276.
—— —— The Survey Gazetteer of the British Isles, 54.
—— —— The Survey Atlas of England and Wales, *rev.*, 108.
Bastian, Professor Adolf, Obit. notice, 220.
Bathymetrical Survey of the Fresh-Water Lochs of Scotland. Part VII. Under the Direction of Sir John Murray, K.C.B., F.R.S., D.Sc., and Laurence Pullar, F.R.S.E., 199, 466.
Beadnell, H. J. L., The Topography and Geology of the Fayum Province of Egypt, 674.
Beannachar, Loch, Survey of, 472.
Beccari, Dr. Odoardo, Wanderings in the Great Forests of Borneo, 54.
Becke, Louis, Notes from my South Sea Log, 673.
Begg, Alexander, Obit. notice, 328.
Belgium and Holland (Baedeker), 285; *rev.*, 337.
Bengal, A Geographical Account of the Countries Round the Bay of (Bowrey), *rev.*, 618.
—— New Province of, 496, 555.
Ben Nevis, Twenty Years on (Kilgour), 456; *rev.*, 563.
—— —— Glacier, A, 270.
—— —— Observatories, Closing of the, 42, 503.
—— —— Observatory Rainfall, 329.
—— —— —— Rainfall, Erratum, 388.
Bensusan, S. L., Lectures by, 97.
Berar, Province of, 661.
Berger, Dr. E., Mythische Kosmographie der Griechen, 286.
Bermuda Islands and Bermuda Biological Station, 499.
Bernacchi, L. C., on the Work of National Antarctic Expedition, 643.
Blair Atholl, Pitlochry and Aberfeldy, The Geology of the Country round (Barrow, Wilson, and Craig), 456.
Bleu, Dans les Rapides du Fleuve (Hourst), 54; *rev.*, 225.
Blond, Mrs. Aubrey Le, Cities and Sights of Spain, 399; *rev.*, 507.
Boehm, Sir Edgar Collins, The Persian Gulf and South Sea Islands, *rev.*, 110.
Boers au XIX. Siecle, L'Expansion des (Dehérain), *rev.*, 510.
Bolivia and Peru around Lake Titicaca, Notes on a Journey in. Arthur W. Hill, M.A., 246.
—— Area, Climate and Population, 215.
—— Geographical Sketch, 286.
Borchgrevink, Carsten E., Das Festland am Südpol, 285.
—— —— Naermest Sydpolen, Aaret 1900, 285.
Borneo, Wanderings in the Great Forests of (Beccari), 54.
—— British North, Area and Population, 312.
—— —— —— Climate, 313.
—— —— —— **Notes on a Journey through. By Andrew Burt, 312.**
—— —— —— Minerals, 313.
Botanical Survey of Scotland: Pts. III. and IV., Forfar and Fife. By William G. Smith, B.Sc., Ph.D., 4, 57, 117.
Bottego, Captain, Explorations in Abyssinia, 260.
Boule, Marcellin, on his Researches in the Mentone Caves, 43.
Boulenger, G. A., on the Distribution of African Fresh-Water Fishes, 644.

Bourdaret, Émile, En Corée, *rev.*, 51.
Bowrey, Thomas, A Geographical Account of the Countries Round the Bay of Bengal, *rev.*, 618.
Brabant, Province of North, Population and Area, 97.
Bradley, A. G., Canada in the Twentieth Century, 674.
Bradley-Birt, F. B., The Story of an Indian Upland, 285; *rev.*, 397.
Branford, V. V., Sociological Papers, 116; *rev.*, 169.
Branner, Professor, or Geological Peculiarities on the North-East Coast of Brazil, 273.
Brazil, Geological Peculiarities on the North-East Coast of, 273.
Brazza, Count Savorgnan de, Obit. notice, 604.
Briet, Lucien, on a Visit to the Gorge of Escoáin, 271.
Brigham, A. P., Students' Laboratory Manual of Physical Geography, *rev.*, 53.
Brighton and Hove, Pictorial and Descriptive Guide to (Ward Lock), *rev.*, 338.
Britain, Rainfall of, 75.
British Association, Address to the Geographical Section of the. By Rear-Admiral Sir W. J. L. Wharton, K.C.B., F.R.S., 513.
—— —— Arrangements for the Meeting of the, 105.
—— —— A. Silva White appointed Assistant Secretary, 107.
—— —— for the Advancement of Science, Report of the, 399.
—— —— **Geography at the, 643.**
—— —— Meeting. List of Office-bearers, 276.
—— —— South African Meeting of the, 448.
—— —— **The Tour of the. By Professor J. Y. Simpson, D.Sc., 637.**
—— Isles, The (Crook and Weston), *rev.*, 343.
—— —— The Survey Gazetteer of the (Bartholomew), 54.
—— New Guinea, Annual Report of, 674.
—— **North Borneo, Notes on a Journey through. By Andrew Burt, 312.**
British Rainfall (Mill), 568.
Britton, Dr. N. L., on the Geology and Flora of the Bahama Islands, 557.
Brown, A. Samler and G. Gordon, A Guide to South Africa, 674.
—— **R. N. Rudmose, B.Sc., and J. H. Harvey Pirie, B.Sc., M.B., The Scottish National Antarctic Expedition: Second Arctic Voyage of the *Scotia*, 24.**
—— —— —— Lectures by, 42.
—— —— **Argentine Antarctic Station, 207.**
Bruce, William S., Bathymetrical Survey of the South Atlantic Ocean and Weddell Sea, 402.
—— —— **Scottish National Antarctic Expedition, 322.**
Bruce, William S., Some Results of the Scottish National Antarctic Expedition, 401.
Brunel, Ch. Mourey et Louis, L'Année Coloniale, 344; *rev.*, 342.
Bryce, Rt. Hon. J., on the Aims of the Sociological Society, 449.
Burma, Report on the Administration of, 171.
—— Route Book, the, 400.
Burmans, Among the (Cochrane), 54; *rev.*, 223.
Burpee, Lawrence J., Canadian Life in Town and Country, 456; *rev.*, 509.
Burt, Andrew, Notes on a Journey through British North Borneo, 312.
Butter, A. E., Expedition to Abyssinia, 260.

Canada as it is (Fraser), 344.
—— in the Twentieth Century (Bradley), 674.
—— Mineral Resources of, 394.
—— Report of the Geographic Board of, 286.
—— Report of the Geological Survey Department of, 116.
—— Summary Report of the Geological Survey Department of, 568.
—— The Statistical Year-Book of, 568.
Canadian Birds, Catalogue of (Macoun), 116.
—— Life in Town and Country (Morgan and Burpee), 456; *rev.*, 509.
—— Rockies, Glaciers of the, 391.
Candler, Edmund, The Unveiling of Lhasa, 228; *rev.*, 246.
Cape Colony, H. C. Schunke-Hollway on the Physical Geography of, 644.
—— to Cairo Railway, Extension of the, 49.
Capenny, S. H. F., Colonel Harding in Remotest Barotseland, 484.
—— —— **The Anglo-Abyssinian Boundary in East Africa, 260.**
—— —— **The Anglo-Portuguese Boundary in Central Africa, 440.**
Caspian Sea, Scientific Investigations, 99.
Cattell, Edward James, Panama, 568; *rev.*, 673.
Caverns on Topography, Influence of, 220.
Chad, Lake, Benue-Logone Route to, 608.
—— —— Collection of Fish from, 557.
—— —— Drying up of, 214.
—— —— Zoology of the District Round, 214.
Chaix, Emile, Notes d'Analyse Géographique, *rev.*, 620.
Challaye, Félicien, Au Japon et en Extreme-Orient, 399; *rev.*, 452.
Chamonix and the Range of Mont Blanc, A Guide to (Whymper), 456.
Chapman, General, C.B., The Proposed Chair of Geography in the University of Edinburgh, 197.
Charcot, Dr., Arrival at Puerto Madryn, 217.

Charcot, Dr., the Results of the French Antarctic Expedition, 463.
Charles-Lavangelle, Henri, Topographie Pratique de Reconnaissance et d'Exploration suivie de Notions Elémentaires Pratiques de Géodésie et d'Astronomie de Compagne, 399.
Chatham Islands, Relation to the Antarctic Continent, 409.
Chengtu to Tibet, Journey from, 555.
Chile, Sinopsis Estodistica I. Jeografica de la Republica de, 400; 568.
Chinese, Characteristics of the, 367.
Chiulinn, Loch a', Survey of, 470.
Chroisg, Loch a', Survey of, 467.
Clarke, W. Eagle, Lectures by, 42.
—— —— on the Birds of Gough Island, 448.
Climate, Professor A. Penck on Changes of, 645.
Clough, C. T., Geology of West-Central Skye, 286.
—— —— Memoirs of the Geological Survey, Scotland, *rev.*, 337.
Cobham, Claude D., A Handbook of Cyprus, 456; *rev.*, 338.
Cochrane, Henry Park, Among the Burmans, 54; *rev.*, 223.
Cocos, The Island of, On the Tract of Treasure (Montmorency), 116.
Coghlan, T. A., A Statistical Account of Australia and New Zealand, 286; *rev.*, 114.
Culbeck, Captain, on Antarctic Sea-ice, 320.
Colombo, Ezio, La Republica Argentina, *rev.*, 620.
Colonial Institute, Proceedings of the Royal, 568.
Coloniale, L'Année (Brunel), 344; *rev.*, 342.
Congo, French, Population of, 608.
—— Sleeping Sickness in the, 45.
Congo Free State, Area, 187.
—— —— —— Railways, 195.
—— —— —— **The Economic Expansion of the. By Ch. Sarolea, D.Ph., D.Litt., F.R.S.E., 182.**
Conon Basin, Notes on the Biology of the. By James Murray, 482.
—— —— **Notes on the Geology of the. By B. N. Peach, LL.D., and John Horne, LL.D., F.R.S., 477.**
—— —— Survey of the Lochs of the, 466.
Conway, Sir W. Martin, Early Dutch and English Voyages to Spitzbergen, *rev.*, 281.
—— Sir Martin, Royal Geographical Society's Founder's Medal awarded to, 276.
Cook, Mrs. E. T., From a Holiday Journal, *rev.*, 115.
Cook's Voyage Round the World, Illustrations of the Botany of Captain (Banks and Solander), 344.
Córdoba, Geografia de la Provincia de (Achavel), 568; *rev.*, 671.
Corée, En (Emile Bourdaret), *rev.*, 51.
Coorg, Report of the Administration of, 116.
Coorg, Report of the Archæological Survey of Madras and, 116.
Costa Rica, Agriculture in, 667.
Cotton, Major Powell, Expedition to Upper Nile, 608.
Cotton-Growing in the Sudan, 49.
—— in the West Indies, 108.
Courtellemont, Gervais, Voyage au Yunnan, *rev.*, 223.
Craig, E. H. Cunningham, The Geology of the Country Round Blair Atholl, Pitlochry, and Aberfeldy, 456.
Crann, Loch, Survey of, 467.
Creak, Captain E. W., on Terrestrial Globes, 649.
Creige Duibhe, Survey of Loch na, 205.
Crook, C. W., The British Isles, *rev.*, 343.
—— —— Our English Home, *rev.*, 343.
Cuba, The Teaching of Geography in Schools in, 591.
Culen, Loch, Survey of, 470.
Cunnington, W. A., on his Scientific Investigations on Lake Nyassa, 212.
Cyprus, A Handbook of (Hutchinson and Cobham), 456; *rev.*, 338.
—— Blue-Book, 116, 568.

Dalkeith, Earl of, M.P., elected Vice-President of the Society, 675.
Dänemarks Natur und Volk (Löffler), *rev.*, 617.
Danish Biological Station to the Board of Agriculture, Report of the (Peterson), 674.
Dansey, Rev. R. P., on the Ben Nevis Glacier, 270.
Das, Sarat Chandra, Travels in Tibet, 229.
Davis, Prof. W. M., on the Sculpture of Mountains by Glaciers, 645.
Dawson, Samuel Edward, The Saint Lawrence Basin and its Borderlands, 399.
Dehérain, Henri L'Espansion des Boers au XIX. Siècle, *rev.*, 510.
Demangeon, Albert, La Picardie et les Régions Voisines, 285; *rev.*, 615.
Denmark and Scotland, Dr. C. Wesenburg on the Contrast between the Lakes of, 153.
Deutschlands, Handbuch der Wirtschaftskunde, *rev.*, 222.
Diego Alvarez, or Gough Island. By R. N. Rudmose Brown, B.Sc., 430.
Dilate, Loch, Survey of, 202.
Dingelstedt, Victor, East and West, 361.
Discovery Antarctic Expedition, A New Genus of Pelagic Algæ, 158.
—— —— —— Exhibition of Pictures and Photographs, 105.
Dodge, R. E., Advanced Geography, 116; *rev.*, 227.
—— —— Elementary Geography, 116; *rev.*, 115.
Douglas, R. K., Europe and the Far East, *rev.*, 50.
Dove, Prof. Karl, On the Economic Future of Africa, 161.

Dryer, Henry, Dai Nippon: The Britain of the East, 228; *rev.*, 395.
—— Prof., on Practical Geography in Schools, 106.
Dubh, Loch, Survey of, 203.
Dupontès, M. Chemin, L'Année Coloniale, *rev.*, 342.
Durkheim, E., Sociological Papers, 116; *rev.*, 169.
Dutton, Clarence E., Earthquakes in the Light of the New Seismology, *rev.*, 114.

Earth, The Face of the (Suess), 54; *rev.*, 168.
Earth History, Problems of, 333.
Earthquakes in the Light of the New Seismology (Dutton), *rev.*, 114.
East and West. By Victor Dingelstedt, 361.
Eckert, Dr. Max, Grundries der Handelsgeographie, 116; *rev.*, 284.
—— —— Leitfader der Handelsgeographie, 674.
Edén, Nils, Sweden for Peace, 568.
Egypt, The Topography and Geology of the Fayum Province of (Beadnell), 674.
Egypte Ignorés, Coins d' (Goyet), *rev.*, 619.
Eilt, Loch, Survey of, 202.
El Dorado, In Search of (Macdonald), 568.
Eliot, Sir Charles, on the Southern Advance of the Abyssinians, 263.
El-Ksar, Description of, 87.
England and the English (Peters), 54; *rev.*, 221.
—— and Wales, The Survey Atlas of (Bartholomew), *rev.*, 108.
Erdbebenkunde, Handbuch der (Sieberg), *rev.*, 114.
Erdsphäroid und seine Abbildung, Das (Dr. Emil Haentzschel), *rev.*, 53.
Erichsen, Mylius, Proposed Arctic Expedition, 609.
—— —— Plans of proposed Arctic Expedition, 663.
Erythräa und der Ægyptische Sudân (Schoenfeld), 54.
Escoáin, The Gorge of, 271.
États-Unis au XX^e^ siècle, Les (Leroy-Beaulieu), *rev.*, 111.
Euphrates, By Nile and (Geere), *rev.*, 111.
Europe (Mingard), *rev.*, 343.
—— and the Far East (Douglas), *rev.*, 50.
—— Travels of a Naturalist in Northern (Harvie-Brown), *rev.*, 669.
Eye, Loch, Survey of, 476.

Falkland Islands, Flora and Fauna, 47.
Fannich, Loch, Survey of, 470.
Far East, The (Little), 568.
—— —— and Europe, The (Douglas), *rev.*, 50.
Faroes and Iceland, the (Annandale), 456; *rev.*, 615.
Fayûm Flint Implements, H. W. Seton-Karr on, 447.
Ferrar, H. T., on the Geology of South Victoria Land, 646.
Ferrar, Mr., on the Physical Geography of the Antarctic, 320.
Ferrier, J. P., Caravan Journeys and Wanderings in Persia, Afghanistan, Turkestan, and Beloochistan, 228.
Fez, Description and Population, 90.
Fife, Botanical Survey of, 4, 57, 117.
Firth, C. H., A Plea for the Historical Teaching of History, 171
Forbes, H. O., on the Relation of the Chatham Islands to the Antarctic Continent, 409.
—— Major W. Lachlan, elected Secretary, 603.
Forfar, Botanical Survey of, 4, 57, 117.
Fosse, C. F. De La, History of India, 674.
France et le Siam, La (Lepesqueur), 568.
Fraser, John Foster, Canada As It Is, 344.
—— Malcolm A. C., Western Australian Year-Book, 1900-3, *rev.*, 114.
Frech, Prof., on Problems of Earth History, 333.
French Antarctic Expedition, The, 463.
—— —— —— Arrival at Puerto Madryn, 217.
—— —— —— Members awarded the Crosses of the Légion d'Honneur, 449.
Freshfield, Douglas W., The Sikhim Himalaya, 173.
—— —— Lectures by, 153.
—— —— on Kinchenjunga, 230.
—— —— on The Teaching of Geography, 106.
Friedrich, Dr. Ernest, Allgemeine und Spezielle Wirthschaftsgeographie, *rev.*, 620.

Galapagos Islands, Soundings in the Vicinity of the, 392.
Galton, F. E., Sociological Papers, 116; *rev.*, 169.
Gardiner, Stanley, Expedition for the Investigation of the Indian Ocean, 449, 562, 664.
Garstin, Sir William, Report upon the Basin of the Upper Nile, *rev.*, 126.
Garve, Loch, Survey of, 474.
Gayet, Albert, Coins d'Egypte Ignorés, *rev.*, 619.
Geddes, Professor Patrick, A Great Geographer: Elisée Reclus, 1830-1905, 490, 548.
—— —— on a Model Geographical Institute, 310.
—— —— Sociological Papers, 116; *rev.*, 169.
Geere, H. Valentine, By Nile and Euphrates, *rev.*, 111.
Geikie, Sir Archibald, awarded the Livingstone Medal, 603.
—— —— Landscape in History, 285.
—— —— Landscape in History and other Essays, *rev.*, 340.

Geil, William Edgar, A Yankee in Pigmy Land, 673.
Geographen-Kalendar (Haack), *rev.*, 342.
Geographer, A Great: Elisée Reclus, 1830-1905. By Professor Patrick Geddes, 490, 548.
Geographical and Topographical Terms, Glossary of (Knox), *rev.*, 166.
—— Association, Report of the Annual Meeting, 106.
—— Index to Books, Periodicals, etc., 568.
—— **Method, On, 309.**
—— Scholarship at Oxford, 394.
Géographique, Notes d'Analyse (Chaix), *rev.*, 620.
Geographisches Jahrbuch (Wagner), 286.
Geography, Advanced (R. E. Dodge), 116; *rev.*, 227.
—— Appeal for Funds for the proposed Chair of, 198.
—— at the University, The proposed Chair of, 96.
—— Douglas Freshfield on the Teaching of, 106.
—— Elementary (Dodge), 116; *rev.*, 115.
—— in Schools, Prof. Dryer on Practical, 106.
—— **in the Schools in Cuba, The Teaching of, 591.**
—— **in the University of Edinburgh, The Proposed Chair of. By General Chapman, C.B., 197.**
—— in the University of Edinburgh, The Proposed Chair of, 309.
—— Students' Laboratory Manual of Physical (Brigham), *rev.*, 53.
—— The Junior (Herbertson), 568.
—— **The Value of (Editorial), 1.**
Geologia Chimica, Contribuzioni di (Spezia), 286.
Géologique, La Science (Launay), 288; *rev.*, 455.
Georgians, Characteristics of the, 367.
Germany, Potash Industry of, 276.
Gibbons, Major, awarded the Society Silver Medal, 603.
Gila Valley, The Underground Waters of the, 101.
Gilbert, Prof. C. K., on a Scheme for Obtaining Subterranean Temperatures, 275.
Gissing, George, By the Ionian Sea, 285; *rev.*, 388.
Glaciers and Glaciation (Harriman), *rev.*, 226.
Glasfurd, Captain A. I. R., Rifle and Romance in the Indian Jungle, 344; *rev.*, 397.
Glass, Loch, Survey of, 475.
Glover, G. L., Australasia, *rev.*, 343; 568.
Gore, Colonel St. G. C., Report on the Operations of the Survey of India, 116.
Gorgona Island, Expedition to, 447.
Gough Island, or Diego Alvarez. By R. N. Rudmose Brown, B.Sc., 430.
—— —— Flora and Fauna of, 30.
Gough Island, W. Eagle Clarke on the Birds of, 448.
Gown, Loch, Survey of, 468.
—— North Loch, Survey of, 468.
—— South Loch, Survey of, 468.
Grampian Area, Botanical Survey of the, 57.
Greece (Baedeker), 344; *rev.*, 564.
Greene, Colonel W. C., Expedition to Sierra Madre Mountains, 497.
Greenland, Proposed Biological Station in, 105, 274.
—— Return of the Mylius-Erichsen Expedition from, 47.
Gregory, Prof., on the Antiquity of Man in Victoria, 217.
—— Sir Augustus. Obituary notice, 445.
Griechen, Mythische Kosmographie der (Berger), 286.
Groll, Max, on his Survey of the Oeschinen Lake, 268.

Haack, Dr. Hermann, Geographen-Kalendar, *rev.*, 342.
Haddon, Dr., On the Peoples of South Africa, 644.
Haentzschel, Dr. Emil, Das Erdsphäroid und seine Abbildung, *rev.*, 53.
Hahn, Dr. J., Meteorology and Glaciation, 612.
Hakluyt, Richard, The Principal Navigations, Voyages, Traffiques, and Discoveries of the English Nation, 399; *rev.*, 282, 566.
Hamilton, William J., Researches in Asia Minor, Pontus, and Armenia, 228.
Harding, Colonel Colin, In Remotest Barotseland. By S. H. F. Capenny, *rev.*, 484; 456.
Harker, A., Memoirs of Geological Survey of the United Kingdom, *rev.*, 162
Harriman, Grove Karl Gilbert, Alaska, *rev.*, 226.
Harrison, Alfred H., Proposed Arctic Expedition, 609.
Harvie-Brown, J. A., Travels of a Naturalist in Northern Europe, *rev.*, 669.
Hayward, Chas. F., Land and Water, *rev.*, 343.
—— —— Tales of Travel, *rev.*, 343.
Hazell's Annual for 1905, *rev.*, 170.
Hazledine, G. D., The White Man in Nigeria, *rev.*, 52.
Heatley, J. T. P., The Development of Rhodesia and its Railway System in Relation to Oceanic Highways, 137.
Hebrides, Pigmies in the: A Curious Legend. By W. C. Mackenzie, F.S.A. Scot., 264.
Hedin, Sven, Adventures in Tibet, 54.
Heilprin, Angelo, The Tower of Pelée, 116; *rev.*, 280.
Hell, Xavier Hommaire de, Voyage en Turquie et en Perse, 228.
Henderson, George, Lahore to Yarkand, 170.
Herbertson, Dr. A. J., On a New Rainfall Map of Africa, 649.
—— —— The Junior Geography, 568.

Hettner, A., Das Europäische Russland, 568; *rev.*, 616.
Highlands, The Geography of Religion in the, *rev.*, 451.
Hill, Arthur, Lectures by, 97.
—— **Arthur W., M.A. Notes on a Journey in Bolivia and Peru around Lake Titicaca, 249.**
—— J. G., The Calvert Scientific Exploring Expedition, Australia, 456; *rev.*, 509.
Himalaya, Holy (Oakley), 228; *rev.*, 278.
—— **The Sikhim. By Douglas W. Freshfield, 173.**
Hindu, Characteristics of the, 367.
History, Landscape in (Geikie), 285.
—— A Plea for the Historical Teaching of (Firth), 171.
Holdich, Colonel Sir Thomas, K.C.M.G., India, 54; *rev.*, 163.
—— —— The Countries of the King's Award, 112.
Holiday Journal, From a (Cook), *rev.*, 115.
Holland and Belgium (Baedeker), 285; *rev.*, 337.
Hollis, A. C., The Masai, their Language and Folklore, 228.
Horne, John, LL.D., F.R.S., and B. N. Peach, LL.D., Notes on the Geology of the Conon Basin, 477.
Hosie, A., on a Journey from Chengtu to Tibet, 555.
Hourst, Lt. de Vaisseau, Dans les Rapides du Fleuve Bleu, 54; *rev.*, 225.
Howel, Thomas, A Journal of the Passage from India, 228.
Howitt, A. W., The Native Tribes of South-East Australia, 54.
—— Mr., on the Antiquity of Man in Victoria, 217.
Hudson, W. H., The Purple Land, 228; *rev.*, 279.
Huntington, Ellsworthy, Expedition to Turkestan, 155.
—— —— **The Depression of Sistan in Eastern Persia, 379.**
Hutchins, E., On the Indigenous Forests of South Africa, 645.
Hutchinson, Sir J. T., A Handbook of Cyprus, *rev.*, 338; 456.
Hutton, Captain F. W., on a Former extensive Antarctic Continent, 559.

Iceland, New Survey of, 155.
—— The Faroes and (Annandale), 456; *rev.*, 615.
—— T. S. Muir on the Survey of Iceland, 276.
India (Holdich), 54; *rev.*, 163.
—— A Journal of the Passage from (Howel), 228.
—— and Madagascar, New British Marine Expedition for Investigating the Oceanography and Biology of the Region between, 337.
—— Earthquake in North-Western, 329.
India, General Report on the Operations of the Survey of, 116.
—— History of (Fosse), 674.
—— Report of the Marine Survey of India, 116.
—— —— of the Meteorological Department of, 116.
—— —— —— Department of the Government of, 674.
—— —— Standard Time in, 390.
Indian Jungle, Rifle and Romance in the (Glasfurd), 344; *rev.*, 397.
—— Ocean, Expedition for the Investigation of the, 449, 562, 664.
—— **Peninsula, Some Geographical Peculiarities of the. By Cameron Morrison, 457.**
—— Upland, The Story of an (Bradley-Birt), 285; *rev.*, 397.
Ionian Sea, By the (Gissing), 285; *rev.*, 338.
Italiana, Statistica della Emigrazione, 116.
Italiano, Annuario Statistico, 116.

Japan, Imperial, The Country and its People (Knox), 285; *rev.*, 338.
—— Queer Things about (Sladen), *rev.*, 51.
Japanese, Characteristics of the, 368.
Japon et en Extrême-Orient, Au (Challaye), 399; *rev.*, 452.
Javanese, Characteristics of the, 367.
Johnston, Col. R. E., On the Work of Ordnance Survey, 643.
Jottrand, M. et de Mme. Émile, Au Siam, 285; *rev.*, 396.
Joûbert, Joseph, Stanley, le Roi des Explorateurs, 286; *rev.*, 453.
Jungle Trails and Jungle People (Whitney), 673.

Kansu, Military Report of the Provinces of Shensi and, 674.
Kelly, John, America, *rev.*, 343.
Keltie, J. Scott, The Statesman's Year-Book, *rev.*, 342.
Kemp, J. F., on the Physiography of the Adirondacks, 558.
Khan, Hadji, With the Pilgrims to Mecca, 228; *rev.*, 279.
Kilgour, Wm. T., Twenty Years on Ben Nevis, 456; *rev.*, 563.
Kinellan, Loch, Survey of, 474.
Kirghiz Steppe, Climate, Flora and Fauna, 389.
Kismayu Roadstead, Concession to Italy of a strip of Territory on the, 214.
Knipowitsch, M., on his Expedition to the Caspian Sea, 99.
Knott, Professor C. G., D.Sc., F.R.S.E., Seismological Studies, 569.
Knox, Alexander, Glossary of Geographical and Topographical Terms, *rev.*, 166.

Knox, G. W., Imperial Japan, 285; *rev.*, 338.
Konstantinopel und Kleinasien (Baedeker), 344; *rev.*, 564.
Kuropatkin, The Campaign with (Story), 54; *rev.*, 164.

Labrador, Macgregor Expedition to, 496.
Lahore to Yarkand (Henderson), 170.
Land, The Purple (Hudson), 228.
—— and Water (Hayward), *rev.*, 343.
Landon, Perceval, Lhasa, 227; *rev.*, 246.
Landscape in History and other Essays (Geikie), *rev.*, 340.
Lanney, L. de, La Science Géologique, 228.
—— —— La Science Géologique, *rev.*, 455.
Lantern, The Other side of the (Treves), *rev.*, 341.
Larash, Description of, 85.
Larminat, E. de, Topographie Pratique de Reconnaissance et d'Exploration, suivie de Notions Elémentaires Pratiques de Géodésie et d'Astronomie de Campaigne, *rev.*, 565.
Laurie Island, Description of, 322.
—— —— Meteorological Observations on, 32.
—— —— Meteorology of, 420, 424.
Lee, Willis T., on the Underground Waters of the Gila Valley, Arizona, 101.
Leeward Islands, Cotton-growing in the, 451.
Lennep, Rev. Henry J. Van, Travels in Little-Known Parts of Asia Minor, 228.
Lepesqueur, Parfait-Charles, La France et le Siam, 568.
Leroy-Beaulieu, Pierre, Les États-Unis au xx^e^ Siècle, *rev.*, 111.
Lespagnol, G., L'Évolution de la Terre et de l'Homme, 285; *rev.*, 454.
Lhasa (Landon), 227; *rev.*, 246.
—— Arrival of Colonel Younghusband at, 240.
—— **The Expedition to. By Ralph Richardson, 246.**
—— The Unveiling of (Candler), 228; *rev.*, 246.
—— at Last, To (Millington), 228; *rev.*, 246.
Limpopo, Geographical Notes on Africa South of the. By F. S. Watermeyer, 625.
Lindgren, W., on the Snowy Range of New South Wales, 501.
Lipari Islands, In the. By George Yeld, 347.
Little, Archibald, The Far East, 568.
Livingstone, The Township of, 272.
Löffler, Dr. E., Dänemarks Natur und Volk, *rev.*, 617.
Lucas, C. P., A Historical Geography of the British Colonies: The West Indies, 673.
Luichart, Loch, Survey of, 471.
Lyons, Captain H. G., on the Nile Flood and Barometric Variations, 331.

Macdonald, Alexander, In Search of El Dorado, 568.
Macgregor, Sir William, Expedition to Labrador, 496.
MacIver-Randall, on the Rhodesian Ruins, 651.
M'Kenzie, Frederick Arthur, From Tokio to Tiflis, 399; *rev.*, 508.
Mackenzie, W. C., F.S.A. Scot., Pigmies in the Hebrides: A Curious Legend, 264.
Maclaren, J. M., on the Geology of Upper Assam, 557.
Macmillan Expedition to Abyssinia and the Blue Nile, The, 214.
M'Millan Expedition to British East Africa, 607.
Macoun, John, Catalogue of Canadian Birds, 116.
Madagascar et Dépendances, Guide-Annuaire de, *rev.*, 339.
—— Guide-Annuaire de, 344.
—— New British Marine Expedition for investigating the Oceanography and Biology of the Region between India and, 337.
Madras and Coorg, Report of the Archæological Survey of, 116.
—— Presidency, Report of the, 344.
Magnetic Pole, Amundsen's Expedition to the, 156, 393, 664.
Màma, Loch, Survey of, 205.
Manila to Aparri, Proposed Railway from, 159.
Mann, Harold, Sociological Papers, 116; *rev.*, 169.
Maps, New, 55, 171, 286, 400, 511, 621.
Marchi, Di Luigi de, Meteorologia Generale, *rev.*, 342.
Marco Polo, The Travels of (Newnes' Classics), 54; *rev.*, 165.
Mark, Prof. Edward, on the Bermuda Islands and the Bermuda Biological Station, 498.
Markham, Sir Clements, on the Probable Shape of the Antarctic Continent, 376.
—— —— —— on the Work of the Royal Geographical Society, 376.
Marshes and Bogs, Vegetation of, 117.
Maryland, Geological Survey Report on, 286.
Masai, their Language and Folklore, The (Hollis), 228.
Matterhorn, A Guide to Zermatt and the (Whymper), 456.
Mecca, With the Pilgrims to (Khan), 228; *rev.*, 279.
Mediterranean Winter Resorts (Reynolds-Ball), *rev.*, 109.
Mentone Caves, Exploration in the, 43.
Mesopotamia, Irrigation of, 211.
Meteorologia Generale (Marchi), *rev.*, 342.

Meteorology. By R. C. Mossman, F.R.S.E., 417.
Mikkelsen, Einar, Proposed Expedition to North Pole, 608.
Mill, Hugh Robert, British Rainfall, 568.
—— —— —— The Siege of the South Pole, 673.
Millington, Powell, To Lhasa at Last, 228; *rev.*, 246.
Mineral Matter of the Sea, The. By Prof. R. D. Salisbury, 132.
Mingard, W. Vere, Europe, *rev.*, 343.
Missouri and Arkansas, Sunk Lands of, 390.
Monaco, Prince of, and Oceanographical Research, 335.
Moncrieff, A. R. Hope, The World of To-day, 228, 456; *rev.*, 565.
—— Col. Sir C. Scott, on Irrigation, 644.
Mont Blanc, A Guide to Chamonix and the Range of (Whymper), 456.
Montmorency, Hervey de, on the Track of a Treasure, 116.
Morgan, Henry J., Canadian Life in Town and Country, 456; *rev.*, 509.
Morie, Loch, Survey of, 476.
Morocco, Letters from, 37, 84.
Morris, Sir Daniel, on Agriculture Development in the West Indies, 221.
Mossman, R. C., Awarded the Society Silver Medal, 603.
—— —— —— **F.R.S.E., The Recent Voyage of the *Uruguay*, 323.**
—— —— —— on the First Year's Work of the Argentine Meteorological Antarctic Station, 207.
—— —— —— **Meteorology, 417.**
—— —— —— on the Argentine Antarctic Station, 331.
Moulin, René, Une Année de Politique Extérieure, 344; *rev.*, 453.
Mountmorres, Lord, on the Commercial Future of Central Africa, 450.
Muir, T. S., on the Survey of Iceland, 270.
Murray, James, Notes on the Biology of the Conon Basin, 482.
—— Sir John, Elected Honorary Member of the Boston (Mass.) Natural History Society, 159.
—— —— —— Elected Honorary Member of the Geographical Society of Chicago, 159.
—— —— —— Elected Honorary Member of the Society of Geography of Geneva, 107.
—— —— —— on Relation of Oceanography to other Sciences, 158.
—— —— —— on the Bathymetry, Deposits, and Temperature of the South-Western Pacific, 501.
—— —— —— **K.C.B., F.R.S., D.Sc., and Laurence Pullar, F.R.S.E., Bathymetrical Survey of the Fresh-Water Lochs of Scotland, Part VII., 199; Part VIII., 466.**
Mylius-Erichsen Expedition, Return of the, 47.
Nanking to Shangai Railway, Construction of the, 565.
Nansen, Dr., on the Oscillations of Shore Lines, 334.
—— Fridtjof, The Norwegian North Polar Expedition, 344; *rev.*, 339.
Natal and Zululand, Report of the Geological Survey of, 116.
National Antarctic Expedition, L. C. Bernacchi on the Work of, 643.
—— —— —— **The Scientific Results of the, 318.**
Nebraska, Survey of the Sandhill Region of, 499.
Negritos of Zambales, The, 539; (Reed), *rev.*, 539.
Nettarcourt-Vaubecourt, Jean de, En Zigzag de Singapore à Moscou, 456; *rev.*, 507.
Nevill, H. R., District Gazetteer of the United Provinces of Agra and Oudh, 171.
New Guinea, A. E. Pratt's New Scientific Expedition to, 215.
—— —— Annual Report of British, 674.
New South Wales, Memoirs of the Geological Survey of, 344.
New Zealand, A Statistical Account of Australia and (Coghlan), 286; *rev.*, 114.
—— —— Report of the Department of Lands and Survey of, 116.
Nicobar Islands, The Andaman and (Temple), 286.
Niger, Promenades Lointaines (Paulhiac), *rev.*, 669.
Nigeria, Mineral Survey of, 50.
—— The White Man in (Hazledine), *rev.*, 52.
Nigeria, Northern, Death of Captain Claud Alexander in, 100.
—— —— Collection of Fish from Lake Chad, 557.
—— —— Lieut. Boyd Alexander's Expedition to, 100, 214.
—— —— Lieut. Boyd Alexander on some Results of his Expedition in, 385.
—— —— Lieut. Boyd Alexander's Expedition to, 599.
Nile, Report upon the Basin of the Upper (Garstin), *rev.*, 126.
Nile, Views of the Upper, 126.
—— The (Willcocks), *rev.*, 510.
—— Macmillan Expedition to the Blue, 214.
—— and Euphrates, By (Geere); *rev.*, 111.
—— Flood and Variations in Atmospheric Pressure in North-East Africa, 331.
Nippon, Dai: The Britain of the East (Dyer), 228; *rev.*, 395.
Nordenskjöld, Baron Erland, Expedition to South America, 662.
—— Dr. Otto, Antarctica, 227.
—— —— and Dr. Joh. Gunnar Andersson, Antarctica: or, Two Years among the Ice of the South Pole, *rev.*, 315.

Nordgaard, O., Hydrographical and Biological Investigations in Norwegian Fjords, 286.
Nordlund, K., The Swedish-Norwegian Union Crisis, 568.
North, Alfred J., Nests and Eggs of Birds found breeding in Australia and Tasmania, 116.
Norwegian Fjords, Hydrographical and Biological Investigations in (Nordgaard), 286.
—— North Polar Expedition, The (Nansen), 344; *rev.*, 339.
Nyassa, Lake, Exploration of, 212.

Oakley, Sherman, Holy Himalaya, 228: *rev.*, 278.
Oceanographical and Fisheries Exposition, Proposed International, 667.
—— Research by the Prince of Monaco, 335.
Oceanography to other Sciences, Relation of, 158.
Odlum, George M., The Culture of Tobacco, 171.
Oeschinen Lake, Survey of the, 268.
Ogilvie, J. H., on the Glaciers of the Canadian Rockies, 391.
Oldham, Yule, on the Unveiling of Africa, 645.
Olsson-Seffer, Dr. Pehr, on the Proposed Biological Station in Greenland, 274.
Ommanney, Admiral Sir Erasmus, Obit. notice, 107.
Ordnance Survey, Col. Johnston on the work of, 643.
—— —— Report of the Progress of the, 568.
—— —— Report, 606.
Orient, Relations de Voyages en (Aucher-Eloy), 228.
Orléans, Duc d', New North Polar Expedition, 333.
—— —— Arctic Expedition, 610.
Oudh, District Gazetteer of the United Province of Agra and (Nevill), 171.
Outlook Tower as a model Geographical Institute, The, 310.
—— —— Syllabus of Lectures, 612.
Oxford School of Geography Report, 611.

Pacific, North, Magnetic Survey of, 666.
—— South-Western. The Bathymetry Deposits and Temperature of the, 501.
Panama Canal, Problems of the (Abbot), 399; *rev.*, 308.
—— Foreign Commercial Guides (Cattell), 568; *rev.*, 673.
Paraguay y Missiones Guaranies, Geografia Fisica y Esferica de las Provincias del (Azara), *rev.*, 280.
Patron, Luis Riso, La Cordillera de los Andes; *rev.*, 565.
Paulhiac, H., Promenades Lointaines, Sahara, Niger, Tombouctou, Touareg; *rev.*, 669.
Peach, B. N., LL.D., and John Horne, LL.D., F.R.S., Notes on the Geology of the Conon Basin. 477.
Peary, Lieut., New Arctic Expedition, 157, 610.
—— —— New Polar Expedition, 332.
—— —— Arctic Expedition, Departure of the *Roosevelt*, 502.
Pelée, Mount, Renewed Activity of, 392.
—— The Tower of (Heilprin), 116; *rev.*, 280.
Penck, Prof. Albrecht, Neue Karten und Reliefs der Alpen, 400.
—— Professor A., on Changes of Climate, 645.
Persia, Afghanistan, Turkistan, and Beloochistan, Caravan Journeys and Wanderings in Ferrier's, 228.
—— Population of, 366.
—— The Depression of Sistan in Eastern. By Ellsworth Huntington, 379.
Persian Gulf and South Sea Islands, The (Boehm), *rev.*, 110.
Persians, Characteristics of the, 366.
Perthshire Natural History Museum, Illustrated Handbook to the (Rodger), *rev.*, 507.
Peru around Lake Titicaca, Notes on a Journey in Bolivia and. By Arthur W. Hill, M.A., 249.
Peters, Dr. Carl, England and the English, 54: *rev.*, 221.
Petersen, C. G. J., Report of the Danish Biological Station to the Board of Agriculture, 674.
Philippine Islands, Cotton-growing in, 613.
Philippines, Proposed Railways in the, 159.
Physical Geography, Students' Laboratory Manual of (Brigham); *rev.*, 53.
Picardie et les Régions Voisines, La (Demangeon), 285: *rev.*, 615.
Pigmies in the Hebrides: A Curious Legend. By W. C. Mackenzie, F.S.A.Scot, 264.
Pigmy Land, A Yankee in (Geil), 673.
Pinnock, James, Wander Years Round the World, 115; *rev.*, 227.
Pirie, J. H. Harvey, B.Sc., M.B., and R. N. Rudmose Brown, B.Sc., Scottish National Antarctic Expedition: Second Antarctic Voyage of the *Scotia*, 24.
—— —— **Summer Work in the South Orkneys, 34.**
—— —— **Deep-Sea Deposits of the South Atlantic Ocean. 413.**
—— Dr., on the Rocks of the South Orkney Islands, 217.
Pitlochry and Aberfeldy, The Geology of the Country round Blair Atholl (Barrow, Wilson, and Craig), 456.
Place-Names and Scottish Saints, Scottish. By Ralph Richardson, 352.
Poitou, Eugene, Spain and its People, 170.
Politique Extérieure, Une Année de (Moulin), 344; *rev.*, 453.

Portuguese Boundary in Central Africa, The Anglo-. By S. H. F. Capenny, 440.
Powell-Cotton, Major P. H. G., In Unknown Africa, 1, 343; *rev.*, 452.
Pratt, A. E., New Expedition to British New Guinea, 216.
Proceedings of the Royal Scottish Geographical Society, 41, 96, 152, 210, 603, 674.
Pullar, Laurence, and Sir John Murray, Bathymetrical Survey of the Fresh-Water Lochs of Scotland, Part VII., 199; Part VIII., 466.
Punjab, Irrigation in the, 212.
Purple Land, The (Hudson), *rev.*, 279.
Pyrenees, Projected Railway Across, 614.

Quebec, Discovery of a New Mineral District in, 160.

Rain-making among the North American Indians, 46.
Rawling, Captain, Expedition to Western Tibet, 211.
Reclus, Elysée, Death of, 446.
—— —— **1830-1905. A Great Geographer. By Prof. Patrick Geddes, 490, 548.**
Reed, William A., The Negritos of Zambles, *rev.*, 539.
Reynolds-Ball, E. A., Mediterranean Winter Resorts, *rev.*, 109.
Rhodesia, Altitudes, 137.
—— **and its Railway System in Relation to Oceanic Highways, The Development of. By J. T. P. Heatley, 137.**
—— Climate, 137.
—— Cotton-growing, 139.
—— Minerals, 138.
—— Railways, 142.
—— R. MacIver on the Ruins of, 651.
—— Rubber, 139.
—— Tobacco Culture, 138, 139.
Richardson, Ralph, Scottish Place-Names and Scottish Saints, 352.
—— —— **The Expedition to Lhasa, 246.**
Richthofen, Baron von, Obit. notice, 605.
Rodger, Alex. M., Illustrated Handbook to the Perthshire Natural History Museum, *rev.*, 507.
Rogers, A. W., on Glacier Periods in South Africa, 644.
Rosque, Loch, Survey of, 467.
Ross and Cromarty, Place-Names of (Watson), 673.
Royal Scottish Geographical Society, Annual Business Meeting, 675.
—— —— Financial Statement, 678.
—— —— Proceedings of the, 41, 96, 152, 210, 603, 674.
—— —— Report of Council, 676.
Russell, Prof. Israel, on the Influence of Caverns on Topography, 220.
Russia (Wallace), 456; *rev.*, 504.
Russians, Characteristics of the, 369.
Russland, Das Europäische (Hettner), 568; *rev.*, 616.
Ruwenzori, Expedition to Mount, 661.
Ryder, Captain C. H. D., Royal Geographical Society's Patron's Medal Awarded to, 276.
Ryder, Major R. E., awarded the Society Silver Medal, 603.

Sahara, Promenades Lointaines (Paulhiac), *rev.*, 669.
Saint Lawrence Basin and its Borderlands, The (Dawson), 399.
Sakhalin, Island of, *rev.*, 447.
—— Population of, 660.
—— Renaming of the Island of, 659.
Salisbury, Prof. R. D., The Mineral Matter of the Sea, 132.
—— —— on Glaciation in North America, 104.
Saltoun, Lieut.-Col. Lord, elected Vice-President of the Society, 675.
Samoa, Volcanic Eruption at, 662.
Samoan Islands, German Observatory in the, 158.
Sarolea, Ch., D.Ph., D.Litt., F.R.S.E., The Economic Expansion of the Congo Free State, 182.
Scandinavia (Bain), 171; *rev.*, 277.
Schoenfeld, Prof. E. Dagobeft, Erythräa und der Ägyptische Sudân, 54.
Schurke-Hollway, H. C., on the Physical Geography of Cape Colony, 644.
Scientific and Learned Societies of Great Britain Year-Book, 116.
Scotia Bay Meteorological Station, 611.
Scotia, **Second Antarctic Voyage of the. By J. H. Harvey Pirie, B.Sc., M.B., and R. N. Rudmose Brown, B.Sc., 24.**
Scotland, Bathymetrical Survey of the Fresh-Water Lochs of. Part VII. Under the Direction of Sir John Murray, K.C.B., F.R.S., D.Sc., and Laurence Pullar, F.R.S.E., 199.
—— **Bathymetrical Survey of the Fresh-Water Lochs of. Part VIII. Under the Direction of Sir John Murray, K.C.B., and Laurence Pullar, F.R.S.E., 466.**
—— **Botanical Survey of, Parts III. and IV., Forfar and Fife. By William G. Smith, B.Sc., Ph.D., 4, 57, 117.**
—— Memoirs of the Geological Survey (Clough), *rev.*, 337; (Barrow), *rev.*, 617.
—— **The Evolution of the Map of. By J. E. Shearer, F.R.S.G.S., 289, 532.**
—— Twenty-Third Annual Report of the Fishery Board for, 568.
—— and Denmark, Dr. C. Wesenburg on the contrast between the Lakes of, 153.
Scott, Captain, on the Results of the National Antarctic Expedition, 318.
—— Commander R. F., awarded the Hon. Degree of Sc.D. at Cambridge, 394.
—— **National Antarctic Expedition. By William S. Bruce, 322.**
—— —— —— **The Second Antarctic Voyage of the *Scotia*. By J. H. Harvey Pirie, B.Sc., M.B., and R. N. Rudmose Brown, B.Sc., 24.**

Scottish National Antarctic Expedition. Continuance of the Meteorological Station at Scotia Bay by the Argentine Government, 48.
—— —— —— Current Observations in the Antarctic, 336.
—— —— —— Relief of the Meteorological Party at the South Orkneys, 48.
—— —— —— **Some Results of the. By William S. Bruce, 401.**
Scottish Place-Names and Scottish Saints. By Ralph Richardson, 352.
Sea, The Mineral Matter of the. By Prof. R. D. Salisbury, 132.
Seismological Studies. By Prof. C. G. Knott, D.Sc., F.R.S.E., 569.
Seismology, Earthquakes in the Light of the New Dutton, *rev.*, 114.
Seton-Karr, H. W., on Fayum Flint Implements, 447.
Shackleton, Lieut., Lecture by, 42, 210.
Shanghai, Climate of, 99.
—— to Nanking Railway, Construction of the, 563.
Shearer, J. E., F.R.S.G.S. The Evolution of the Map of Scotland, 289, 532.
Shensi and Kansu, Military Report of the Provinces of, 674.
Shepard, Edw. M., on the Sunk Lands of Missouri and Arkansas, 390.
Shiel District, Notes on the Biology of the Lochs of the, 206.
—— Loch, Survey of, 199.
Shore-lines, Dr. Nansen on the Oscillations of, 334.
Siam, Au (Jottrand), 285; *rev.*, 396.
—— Foreign Trade of, 668.
—— La France et le Siam (Lepesqueur), 568.
Siberia (Turner), 568; *rev.*, 652.
Sieberg, August, Handbuch der Erdbebenkunde, *rev.*, 114.
Sierra Leone Government Railway, 562.
Sikhim Himalaya, The. By Douglas W. Freshfield, 173.
Simplon Tunnel, Junction of the Galleries, 221.
Simpson, Professor J. Y., D.Sc. The Tour of the British Association, 637.
Singapore à Moscou, En Zigzag de (Nettarcourt-Vaubecourt), 456; *rev.*, 507.
Sipibo, Diccionario; Castellano-Deutsch-Sipibo (Steinen), 285.
Sistan, Agriculture and Irrigation of, 380.
—— Climate of, 380.
—— in Eastern Persia, The Depression of. By Ellsworth Huntington, 379.
Skye, The Geology of West Central (Clough), 286.
Sladen, Douglas, Queer Things about Japan, *rev.*, 51.
Sleeping Sickness in the Congo, 45.
Smith, Mr. Donaldson, Explorations in Abyssinia, 260.
Smith, William G., B.Sc., Ph.D. Botanical Survey of Scotland. Pts. III. and IV. Forfar and Fife, 4, 57, 117.
Sociological Papers (Galton), 116; *rev.*, 169.
—— Society, Right Hon. J. Bryce on the Aims of the, 449.
Solander, Dr. Daniel, Illustrations of the Botany of Captain Cook's Voyage Round the World, 344.
South Africa, Agricultural and Pastoral Prospects in (Thomas), 54.
—— —— A Guide to (Brown), 674.
South Australia, Results of the Barclay-Macpherson Expedition to Lake Eyre, 500.
South Orkneys, Continuance of the Meteorological Station at Scotia Bay by the Argentine Government, 24, 48.
—— —— Climate of the, 35.
—— —— Dr. Pirie on the Rocks of the, 217.
—— —— Fauna of the, 34.
—— —— Meteorology of, 36.
—— —— R. C. Mossman on the First Year's Work of the Argentine Antarctic Meteorological Station, 207.
—— —— Relief of the Meteorological Station at the, 48, 156.
—— —— **Summer Work in the. By J. H. Harvey Pirie, B.Sc., M.B., 34.**
South Pole, The Siege of the (Mill), 673.
South Sea Islands, The Persian Gulf and (Boehm), *rev.*, 110.
—— —— Log, Notes from My (Becke), 673.
Spain and its People (Poitou), 170.
—— Cities and Sights of (Blond), 399; *rev.*, 507.
Sparrow, W., and Ḥadji Khan, With the Pilgrims to Mecca, *rev.*, 279.
Spencer, Dr. J. W., on the Improbability of Land in the Vicinity of the North Pole, 273.
Spezia, Giorgio, Contribuzioni di Geologia Chimica, 286.
Spitzbergen, Early Dutch and English Voyages to (Conway), *rev.*, 281.
Stanford's Geological Atlas of Great Britain (Woodward), *rev.*, 110.
Stanley, le Roi des Explorateurs, 1840-1904 (Joubert), 286; *rev.*, 453.
Statesman's Year-Book, The (Scott-Keltie), 286; *rev.*, 342.
Steinen, Karl von, Diccionario Sipibo, Castellano-Deutsch-Sipibo, 285.
Story, Douglas, The Campaign with Kuropatkin, 54; *rev.*, 164.
Stromboli, Recent Changes in the Crater of. By Tempest Anderson, M.D., D.Sc., 345.
Sudan Almanac, 116.
—— and Abyssinia, Establishment of a Commercial River Route between, 214.
—— Cotton-growing in the, 49.
—— Dr. Balfour on Malaria in the, 99.
Sudân, Erythräa und der Ægyptische (Schoenfeld), 54.

Südpol, Das Festland am (Borchgrevink), 285.
Suess, Edouard, The Face of the Earth, 54; *rev.*, 168.
Sweden, Distribution of the Population in, 446.
—— for Peace (Edén), 568.
Swedish-Norwegian Union Crisis, The (Nordland), 568.
Switzerland (Baedeker), 456; *rev.*, 564.
Sydpolen, Nærmest, Aaret 1900 (Borchgrevink), 285.

Tanganyika, Lake, Exploration of, 212.
Tangiers, 37.
—— Population of, 39.
Tarnuzzer, Dr. Chr., Grisons (Bündner) Oberland, *rev.*, 564.
Tasmania, Nests and Eggs of Birds found Breeding in Australia and (North), 116.
—— Aboriginals, Origin of the, 217.
Titicaca, The Basin of Lake. By A. F. Bandelier, 582.
Tchihatcheff, P. de, Asie Mineure, Description Physique, 228.
Terre et de l'Homme, L'Évolution de la (Lespagnol), 285; *rev.*, 454.
Thayer, J., Expedition to Gorgona Island, Colombia, 447.
Thomas, Colonel Owen, Agricultural and Pastoral Prospects in South Africa, 54.
Tibet, Adventures in (Hedin), 54.
—— **Mission, The Geographical Results of the. By Sir Frank Younghusband, K.C.I.E., 229.**
—— Western, Captain Rawling's Expedition to, 211,
Tibetans, Characteristics of the, 369.
Tiflis, From Tokio to (M'Kenzie), 399; *rev.*, 508.
Titicaca Island, Climate of, 585.
Titicaca, Notes on a Journey in Bolivia and Peru around Lake. By Arthur W. Hill, M.A., 249.
—— Lake, Flora and Fauna of Region round, 587.
—— —— Mineral Resources of Region round, 586.
Tobacco, The Culture of (Odlum), 171.
Tokio to Tiflis, From (M'Kenzie), 399; *rev.*, 508.
Tombouctou, Promenades Lointaines (Paulhiac), *rev.*, 669.
Topographie Pratique de Reconnaissance et d'Exploration, suivie de Notions Élémentaires Pratiques de Géodésie et d'Astronomie de Campaigne (Larminat), 399; *rev.*, 565.
Topographical Terms, Glossary of Geographical and (Knox), *rev.*, 166.
Topography, Influence of Caverns on, 220.
Touareg, Promenades Lointaines (Paulhiac), *rev.*, 669.
Town and Jungle, Through (W. H. and Fanny B. Workman), 55; *rev.*, 224.
Transvaal, Physical Features of, 647.
Travel, Tales of (Hayward), *rev.*, 343.
Treves, Sir Frederick, The Other Side of the Lantern, 285; *rev.*, 341.
Trevor, T., on the Physical Features of Transvaal, 647.
Tristan d'Acunha, 301.
—— ——, 561.
—— —— Population and Climate, 308.
Turkestan, Ellsworthy Huntington's and R. L. Barrett's Expedition to, 155.
Turner, Samuel, Lectures by, 210.
—— —— Siberia, 568; *rev.*, 652.
Turquie et en Perse, Voyage en (Hell), 228.

Uganda, Climate of, 661.
—— Macmillan Expedition to, 214.
—— Protectorate, Climate, 45.
—— —— Commissioner Sadler's Report, 44.
—— —— Cultivation of Coffee in, 45.
—— —— Cultivation of Cotton in, 45.
—— —— Cultivation of Fibre in, 45.
United Kingdom, Memoirs of Geological Survey of the (Harker), *rev.*, 162.
—— States, Manufacture of Cotton in the Southern, 450.
Uruguay, The Recent Voyage of the. By R. C. Mossman, F.R.S.E., 323.
Ussie, Loch, Survey of, 475.

Valentine, Rupert, on the Flora and Fauna of the Falkland Islands, 47.
Vambery, Arminius, The Story of My Struggles, 54; *rev.*, 166.
Victoria, Annual Report of the Secretary for Mines and Water Supply for, 568.
—— Memoirs of the Geological Survey of, 568.
—— Prof. Gregory on the Antiquity of Man in, 217.
Voss, Captain, Lectures by, 42.

Wagner, Dr. Hermann, Geographisches Jahrbuch, 286.
Wallace, Sir Donald Mackenzie, Russia, 456; *rev.*, 504.
Wallis, James, Asia, *rev.*, 343.
Ward, Lock's Pictorial and Descriptive Guide to Brighton and Hove, *rev.*, 338.
Watermeyer, F. S. Geographical Notes on South Africa south of the Limpopo, 625.
Watson, W. J., Place-Names of Ross and Cromarty, 673.
Watt, Andrew, on the Rainfall of Ben Nevis Observatory, 329.
Weddell Sea, Bathymetrical Survey of the South Atlantic Ocean and. By William S. Bruce, 402.
—— —— **Deep-Sea Deposits of the South Atlantic Ocean and. By J. H. Harvey Pirie, B.Sc., M.B., 413.**
—— —— Soundings in the, 32.
Wesenburg-Lund, Dr. C., on the Lakes of Scotland and Denmark, 153.
West Indies, Agriculture in the, 221.

West Indies, Cotton-growing in the, 108.
—— —— The, A Historical Geography of the British Colonies (Lucas), 673.
Westermarck, E., Sociological Papers, 116; *rev.*, 169.
Western Australian Year-Book (Fraser), *rev.*, 114.
Weston, W. H., Our English Home, *rev.*, 343.
—— —— The British Isles, *rev.*, 343.
Wharton, Rear-Admiral Sir W. J. L., K.C.B., F.R.S., Address to the Geographical Section of the British Association, 513.
—— —— —— Obituary notice, 604.
White, A. Silva, appointed Assistant-Secretary of the British Association, 107.
Whitney, Casper, Jungle Trails and Jungle People, 673.
Whymper, Edward, A Guide to Chamonix and the Range of Mont Blanc, 456.
—— —— A Guide to Zermatt and the Matterhorn, 456.
Wiggins, Captain J., Obit. notice, 605.
Wigner, Dr. J. H., Lectures by, 97.
Willcocks, Sir William, on the Irrigation of Mesopotamia, 211.
—— —— The Assuan Reservoir and Lake Maris, *rev.*, 225.
—— —— The Nile, *rev.*, 510.
Wilson, Edgar, Proposed Arctic Expedition, 610.
—— J. S. Grant, The Geology of the Country round Blair Atholl, Pitlochry, and Aberfeldy, 456.
Winsor, J., The Kohl Collection of Maps relating to America, 286.
Wolcott, R. H., on the Sandhill Region of Nebraska, 499.
Woodward, Horace B., Stanford's Geological Atlas of Great Britain, *rev.*, 110.
Workman, Mrs. Fanny Bullock, appointed Officier de l'Instruction Publique, 159.
—— W. H. and Fanny B., Through Town and Jungle, 55; *rev.*, 224.
World of To-day, The (Moncrieff), 228, 456; *rev.*, 565.
—— Wander Years round the (Pinnock), 115; *rev.*, 227.

Yarkand, Lahore to (Henderson), 170.
Yeld, George, In the Lipari Islands, 347.
Yorkshire Philosophical Society, Report of the, 400.
Younghusband, Colonel Sir F., awarded the Hon. degree of Sc.D. at Cambridge, 394.
—— **Sir Frank, K.C.I.E., The Geographical Results of the Tibet Mission, 229.**
Yunnan, Voyage au (Courtellemont), *rev.*, 223.

Zambesi, Completion of Bridge over, 148.
Zermatt and the Matterhorn, A Guide to, (Whymper), 456.
Ziegler North Polar Expedition, Relief of the, 157.
—— **North Polar Expedition, The, 543.**
—— Relief Expedition, Leave Tromsoe, 393.
Zimbabwe Ruins, 151.
Zululand, Report of the Geological Survey of Natal and, 116.

MAPS, CHARTS, AND DIAGRAMS.

Europe.

PAGE

Section across the Firth of Tay, . 15
Botanical Survey of Scotland, Fife Sheet, ... 23
The Bog-bean Pond, ... 78
The Pondweed and Water Plantain Pond, ... 79
Botanical Survey of Scotland, Forfar Sheet, ... 83
Strabo's Map of the British Isles, about 20 B.C., ... 290
Ptolemy's Map of the British Isles, 150 A.D., ... 290
Santa Cruz's Map of the British Isles, 1542, ... 290
England with Scotland as an Island. By Bordone, 1528, ... 292
Ptolemy's Map of Britain as printed in Bordone's Atlas, 1528, . . 294
Coast-line of the British Isles, attributed to Pierre Desceliers, 1535, ... 296
Coast-line of the British Isles. By Pierre Desceliers, 1546, . . 298
Map of Scotland, printed 1556, . 300
Scotland, Speed's Map, 1610, . . 539
Scotland, Gordon of Straloch's Map, 1653, ... 539

Africa.

Railway Map of South Africa in 1904, ... 144
Plan of Victoria Falls, . . . 151
Map of Rhodesia, ... 152
Congo Free State, Orographical Features, etc., ... 197
Congo Free State, Vegetation Features, etc., ... 197
Congo Free State, Political Divisions, ... 197
Congo Free State, Commercial Products, ... 197
Map Illustrating Abyssinian Frontier Question, ... 263
Map showing the Anglo-Portuguese Boundary in Central Africa, . 441

America.

Map of Pima Indian Reservation, . 102
Cross Section of Gila Valley at The Buttes, Arizona, . . . 103

Antarctic.

Scottish National Antarctic Expedition, Maps showing the Track of the *Scotia*, 1903-1904, . . 37
Sketch Map of Region Explored by the French Antarctic Expedition, ... 218
Map of Laurie Island, South Orkneys, ... 322
Pendulum Cove as surveyed by the Uruguay in January 1905, . 326
Sketch of Gough Island, . . . 431
Scottish National Antarctic Expedition, Bathymetrical Survey of the South Atlantic Ocean and Weddell Sea, ... 440
Scottish National Antarctic Expedition, Deep Sea Deposits of the South Atlantic Ocean and Weddell Sea, ... 440
Region explored by the French Antarctic Expedition, . . 465

ILLUSTRATIONS.

Europe.

PAGE

Ground Vegetation of Wood Hyacinth, Bracken, and Yorkshire Fog, under the open Canopy of an Oak Wood on the Coal Measures of Yorkshire, . . 6
The effect of Beech on the undergrowth in a Yorkshire Wood, . 7
Birch Wood in Glen Clova, looking up the South Esk, . . . 9
Caenlochan Forest at the head of Glen Isla, ... 12

PAGE

Views from the Crags of Lundie towards the south-west along the Sidlaws, ... 18
Cliffs and Coves on the Coast of Forfar between Arbroath and Auchmithie, ... 65
Sand Dunes, Lunan Bay, . . 67
Tentsmoor, Sandy Beach passing into Sand Dune, . . . 68
Tentsmoor, near the Point, . . 72
The Long Loch at Lundie from the south-west end, . . . 76
Methven Loch, ... 77
Loch Brandy 83
Stromboli: The Sciara from the north-east, ... 346
Stromboli: An Explosion—Early Stage, ... 348

ASIA.

The Valley of Kangbachen in Nepal, looking towards Khunza, . . 181
Village near the Lingmatang Plain in the Chumbi Valley, . . 233
Phari Jong, with Chumalkari, 24,300 ft., ... 236
The Yamdok Tso or Turquoise Lake, from the Camp at Tamalong, . 238
The Potala Lhasa, ... 240
The Tsangpo (Brahmaputra) at Chaksam Ferry, ... 242
The Ling Kor or Via Sacra at Lhasa, 244
Katunskié-Belki, with Willer's Peak, 17,800 ft., on extreme right, ... 654
Katunskie-Belki, with Belukha West Peak on extreme right, . 656

AFRICA.

The Bahr-el-Gebel: Fola Rapids, looking upstream, ... 127
The Bahr-el-Gebel: Fola Rapids, looking downstream, . . 127
The Bahr-el-Zaraf, ... 129
The Bahr-el-Ghazal: Mouth of the River Rohl, ... 129
The Bahr-el-Ghazal, showing fringe of Papyrus, ... 131
The Bahr-el-Ghazal: Blocked by Grass Sudd, 1903, ... 131
Views of the Gorge, Victoria Falls, 141
Conical Tower, Zimbabwe Ruins, . 143
Umfali River, crossed by the Railway from Gwelo to Salisbury, . 145

PAGE

The Western Cataract, or Leaping Water, Victoria Falls, . . 148
Looking up the Gorge towards the Victoria Falls. The site of the Railway Bridge is indicated, . 151
The Sirdar visiting Inspector Hanolet at Lado, ... 183
Major Gibbons and the Lemaire Expedition at Lukafu, . . 184
White Staff at Stanleyville, . . 185
Commissaire Royal Malfeyt and his Officers, ... 186
A View on the Railway, . . . 187
View of Railway, ... 188
A Bridge on the Old Caravan Route, 188
Hatende, Chief of Jafunga Village, 190
A Baluba Chief, ... 191
Congo Natives, ... 191
Group of Hollos, ... 192
At Upoto, ... 192
Tapping Rubber Vines in the Forest of Lusambo, ... 195
Valovaie Chiefs at Nyakatoro, . 486
Breakfast: Col. Harding's Native Mounted Servant, . . . 488
Balungwe or Mahuminia Falls or Rapids, Kafue River . . 489
On the Karoo, ... 638
Marriage of Zulu Chief, Henley, Natal, ... 639
Native Hut, Bellairs, Natal, . . 640
'Drift' on the Road, Marico district, Transvaal, ... 642

AMERICA.

Shore of Lake Titicaca near Capacabana, showing the remarkable T-shaped Promontory, with the Island of Titicaca beyond, . 251
An Ancient Stone Figure about 10 ft. high at Tiaguanoco, . . . 253
The shore of Lake Titicaca, near Desaguadero, ... 255
Azorella sp. forming mounds 2 to 3 feet high at about 14,000 ft. on the slopes of El Misti. Drops of resin appear white in the photograph, ... 257
The Uruguay at Buenos Ayres, . 332
Lighthouse at Cape Pembroke, Falkland Islands, ... 418

ANTARCTIC.

Omand House, South Orkneys, . 24
Saddle Island, South Orkneys, . 25

	PAGE
Coats Land,	27
Glen on Gough Island,	29
Cliffs of Gough Island, showing Hanging Valley,	30
Narrow Peninsula on North Coast of Laurie Island,	31
Cape Dundas, eastern extremity of Laurie Island,	32
Glacier at head of Bay, north coast of Laurie Island,	33
Giant Petrel, South Orkneys,	34
Weddell Seal,	35
Hot Springs in Pendulum Cove,	324
The *Uruguay* anchored in Pendulum Cove, Deception Island,	325
Glacier and Waterfall in Beagle Channel,	327
Scotia sounding in supposed Ross Deep,	406
Scotia sounding in supposed Ross Deep, 68° 32′ S., 12° 49′ W.,	406
Alternating Shales and Greywackés in Wilton Bay, South Orkneys,	410
Scotia beset in heavy ice in 74° 1′ S. off Coats Land,	412
Meteorological Instruments at Scotia Bay,	419
Omond House from Scotia Bay, and Meteorological Instruments. Mount Ramsay, Jessie Bay, in background,	427
Gough Island, North-east point looking NNW. Church Rock in foreground,	433
Gough Island, South Point from the East,	435
Gough Island, near the Mouth of the Glen; *Scotia* seen through the Cave,	436
Gough Island, Landing-place at the Mouth of the Glen,	439
General.	
The Lucas Automatic Sounding Machine,	403
Illustrations from Speed's Map of Scotland, 1610,	534

PORTRAITS.

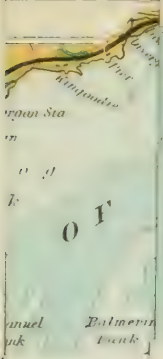
	PAGE
William S. Bruce,	24
Governor-General Baron Wahis,	183
Commodore John Pepper, I.N.,	302
Ann Pepper,	303

END OF VOLUME XXI.

Printed by T. and A. Constable, Printers to His Majesty
at the Edinburgh University Press

CAL S
LATE ROBERT

FIFE SHEET.



EXPLANATION OF COLOURS

TEMPERATE REGION

Ma	Maritime
Aq	Aquatic (*Lowland Swamps*)
W	Cultivation, *with Wheat*
O	Cultivation, *without Wheat, Oats chief crop*
O Pa	Pasture, *included with Cultivation on Ordnance Maps*
M	Mixed Deciduous Woods, *mainly Beech and Oak. Parklands included*

BOTANICAL SURVEY OF SCOTLAND

BY THE LATE ROBERT SMITH, B.Sc., AND WM. G. SMITH B.Sc. PH.D.

FIFE SHEET.

SUR
BERT SMITH

FORFAR SHEET.

BOTANICAL SURVEY OF SCOTLAND

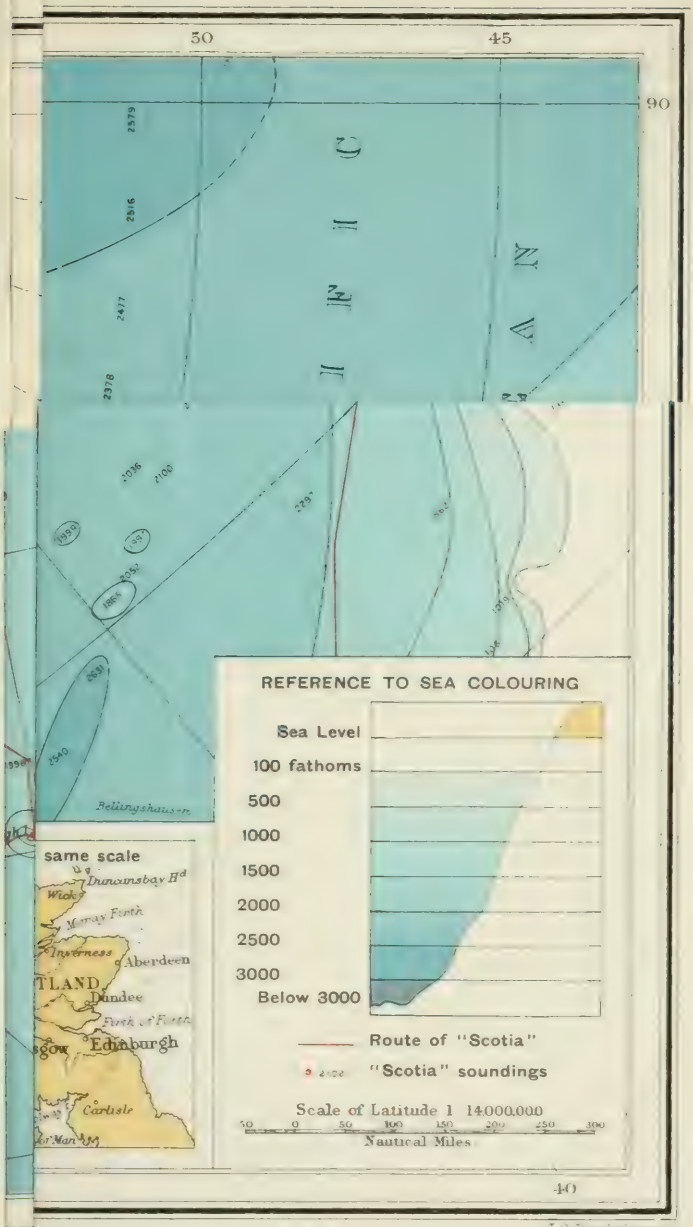
BY THE LATE ROBERT SMITH, B.Sc., AND WM. G. SMITH B.Sc., PH.D.

FORFAR SHEET.

FORFAR
MONTROSE
ARBROATH
DUNDEE
Red Head
Mouth of the Tay
EXPLANATION OF COLOURS
TEMPERATE REGION
Ms Maritime
Aq Arctic-Lowland Swamp
W Cultivation with Wood
O Cultivation without Wood, Grass, Corn, &c.
Mixed Deciduous Woods, mainly
Beech and Oak. Pine Woods ascendant
Oak Woods, Birch predominant or Pine Woods descendant
SUB ALPINE REGION
P Coniferous Woods, mainly Scots Pine
L Coniferous Woods, mainly Larch
BF Birch Woods
Pa Hill and Alpine Pasture with grasses predominant
H Heather Moors and Heaths
PH Mat-grass Hill Pasture and Heather
PaPt Peat Bogs, drained and cut with pasture
ALPINE REGION
Pa Alpine and Hilly Pastures, with grasses predominant
V Alpine Pastures, with Mat-grass, Fescues, Meadow-grasses, Bent-grass, &c.
VH Alpine Moors, with Heaths and Mat-grass predominant

Scottish National Antarctic Expedition.

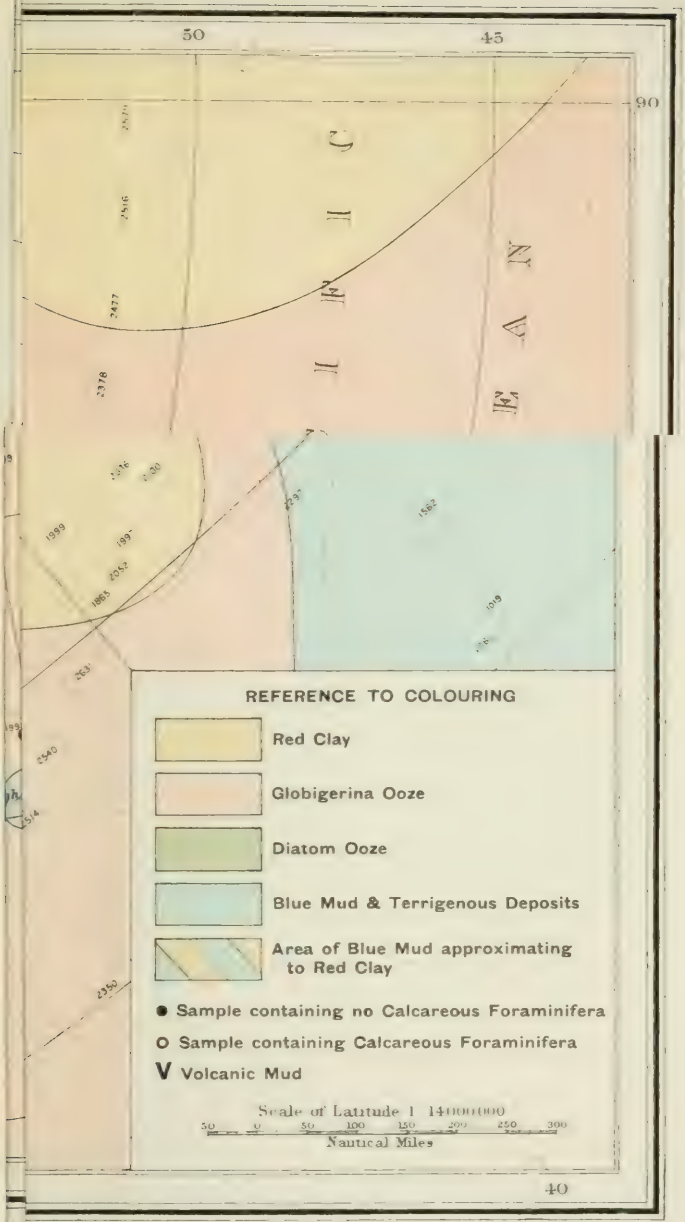
MAP SHOWING THE TRACK OF THE "SCOTIA" 1903-1904.


30
45
90
40
ATLANTIC
OCEAN
2379
2516
2477
2378
1036
2100
2340
Bellingshausen
same scale
Dunnansbay Hd
Wick
Moray Firth
Inverness
Aberdeen
TLAND
Dundee
Firth of Forth
Edinburgh
sgow
Carlisle
REFERENCE TO SEA COLOURING
Sea Level
100 fathoms
500
1000
1500
2000
2500
3000
Below 3000
Route of "Scotia"
"Scotia" soundings
Scale of Latitude 1 14000.000
50 0 50 100 150 200 250 300
Nautical Miles

Scottish National Antarctic Expedition

BATHYMETRICAL SURVEY OF THE SOUTH ATLANTIC OCEAN AND WEDDELL SEA

BY WILLIAM S. BRUCE, F.R.S.G.S.


50
45
90
40
REFERENCE TO COLOURING
Red Clay
Globigerina Ooze
Diatom Ooze
Blue Mud & Terrigenous Deposits
Area of Blue Mud approximating to Red Clay
● Sample containing no Calcareous Foraminifera
O Sample containing Calcareous Foraminifera
V Volcanic Mud
Scale of Latitude 1 140001000
50 0 50 100 150 200 250 300
Nautical Miles

Scottish National Antarctic Expedition

DEEP SEA DEPOSITS OF THE SOUTH ATLANTIC OCEAN AND WEDDELL SEA

BY J. H. HARVEY PIRIE, B.Sc., M.B.

LAKE
MWERU
LAKE TANGANYIKA
Kituta
Abercorn
GERMAN EAS
Fife
CONGO FREE
Shashi
Tati
Macloutsie
Serudi
Scribi
Tepsi
Ndzabi
Tuli
Coalfield
Fort Tuli
Tuli
Australian
R
G U
UAN
ECT

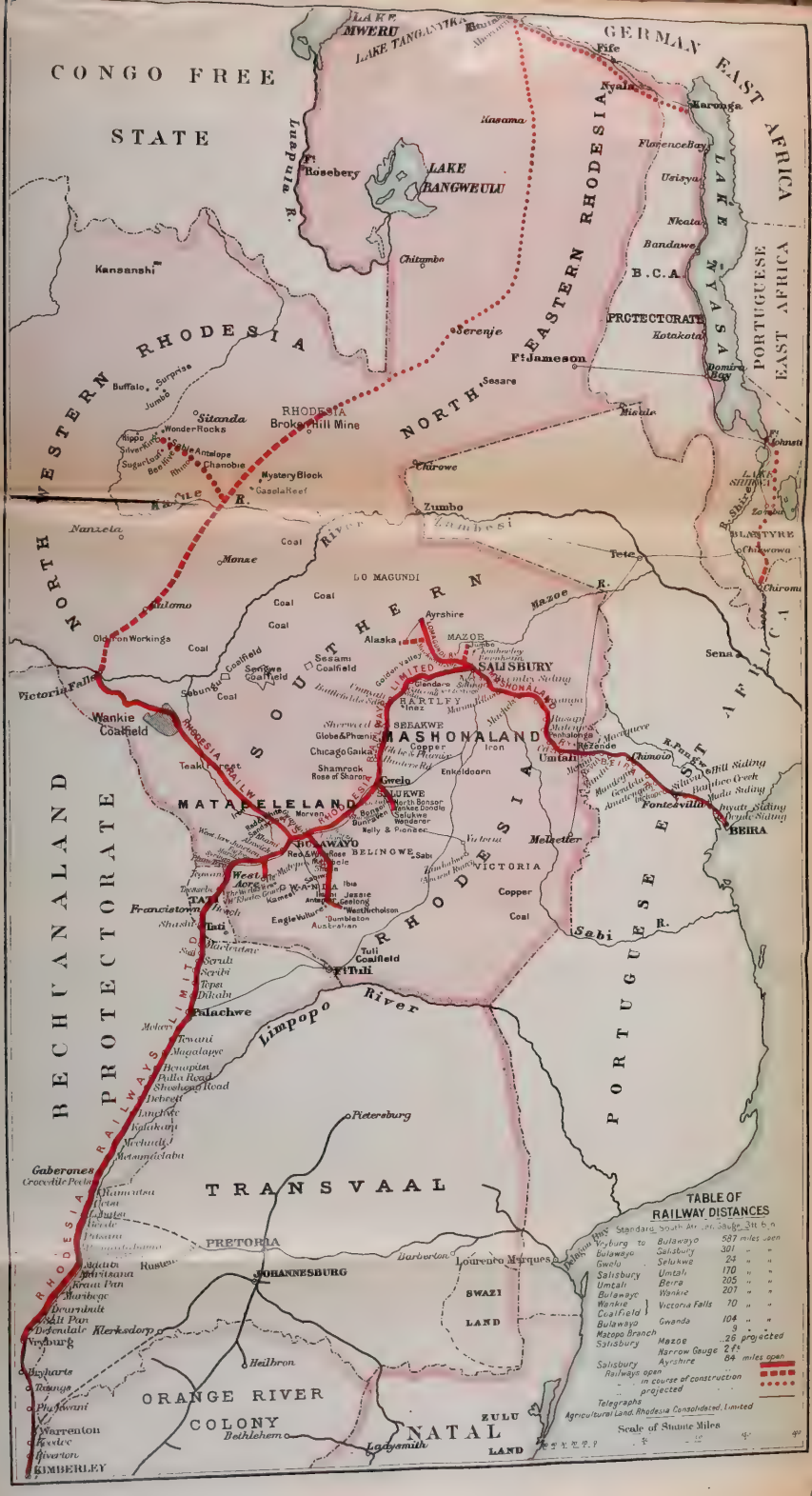


TABLE OF RAILWAY DISTANCES

Standard Gauge 3ft 6 in.

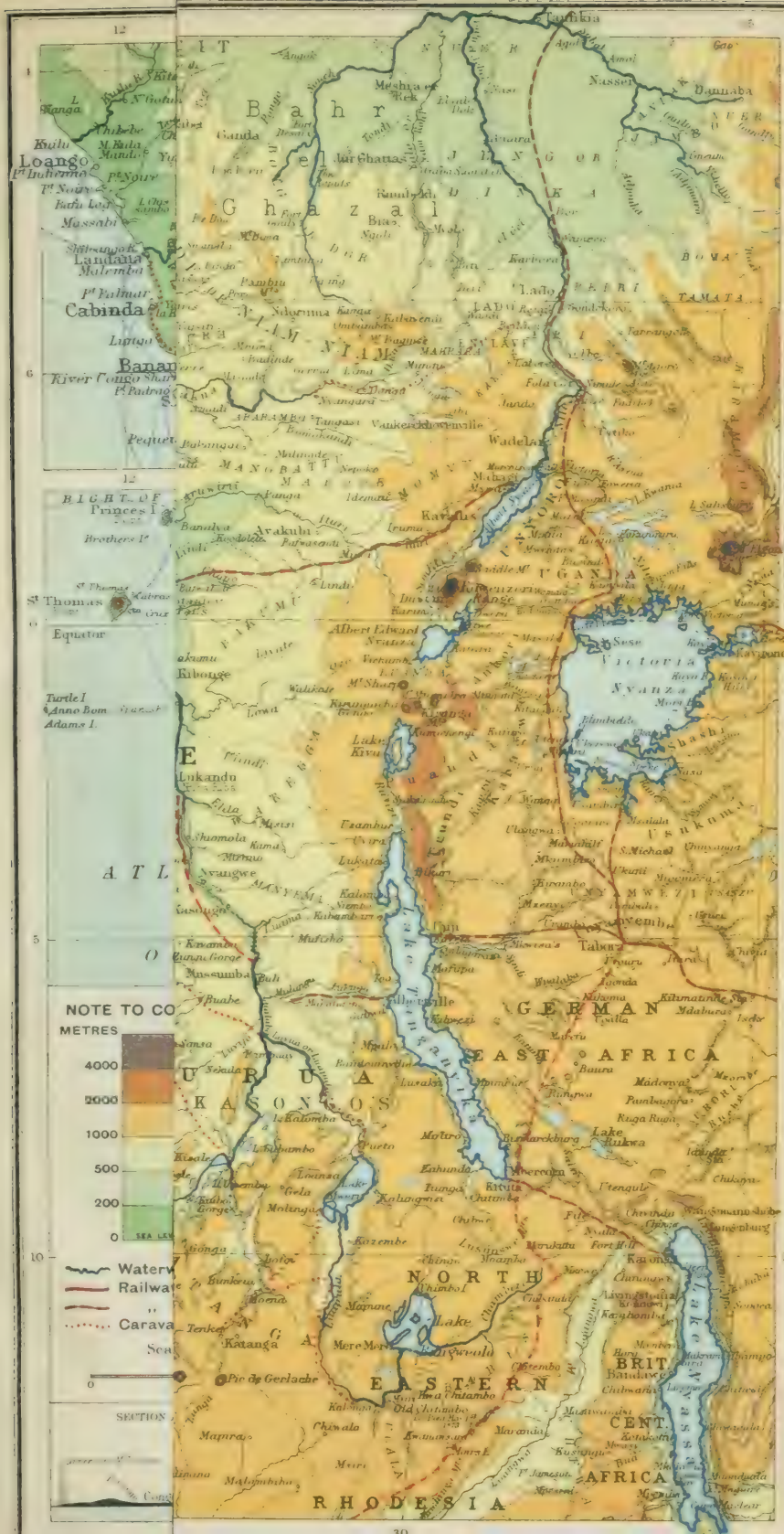
Vryburg to	Bulawayo	587	miles open
Bulawayo	Salisbury	301	" "
Gwelo	Selukwe	24	" "
Salisbury	Umtali	170	" "
Umtali	Beira	205	" "
Bulawayo	Wankie	207	" "
Wankie	Victoria Falls	70	" "
Coalfield			
Bulawayo	Gwanda	104	" "
Matopo Branch		9	" "
Salisbury	Mazoe	26	projected
	Narrow Gauge	2 ft	
Salisbury	Ayrshire	64	miles open

Railways open
" in course of construction
" projected

Telegraphs

Agricultural Land, Rhodesia Consolidated, Limited

Scale of Statute Miles

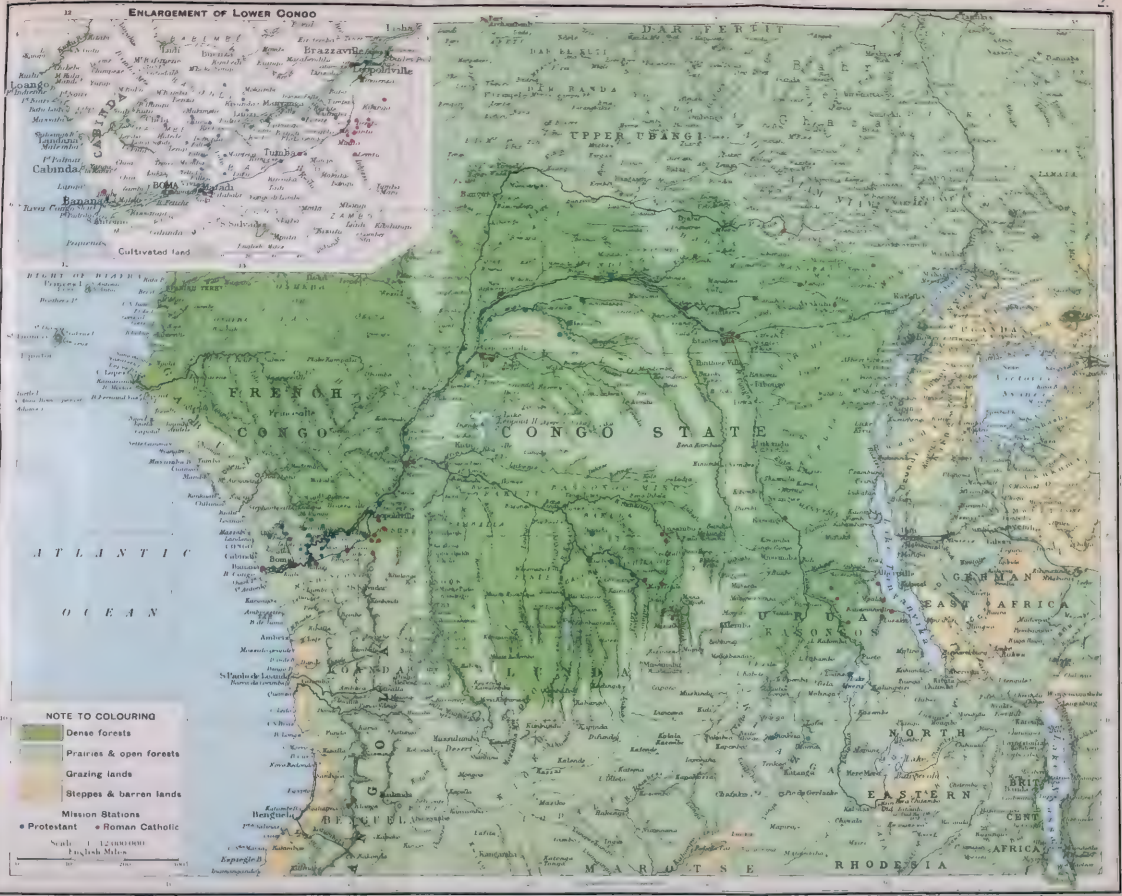

Bahr el Ghazal
Loango
Cabinda
Landana
Malemba
Banana
River Congo
Pt Padrao
Pequeno
Bight of Princes
Princes I
Brothers I
St Thomas
Equator
Turtle I
Anno Bom
Adams I
ATLANTIC OCEAN
Tunisia
Nassori
Damaba
Ganda
Lado
Wadelai
Karuma
Middle Mwutan Nzige
UGANDA
Albert Edward Nyanza
Victoria Nyanza
Kibouse
Lake Kivu
Lukandu
Nyamwezi
Tabora
Mussumba
Lake Tanganyika
GERMAN EAST AFRICA
URUA
KASONGOS
Lake Bangweolo
Lake Nyassa
NORTH EASTERN RHODESIA
BRIT. CENTRAL AFRICA
Katanga
Pic de Gerlache
Mere Mere
Lake Mweru
Lake Tanganyika
Kazembe
Fort Hill
Karonga
Chinde
Mozambique
Quilimane
Zambesi R.
Shire R.
Lake Shirwa
Mlanje
Zomba
Blantyre
Port Herald
Fort Johnston
Kota Kota
Nkata Bay
Tete
Zumbo
Mazaro
Mashona
Matabele
Mashukulumbwe
Barotse
Lunda
Kasonge
Kabompo
Kalomo
Kafue R.
Victoria Falls
Zambesi R.
Mosioatunya
Sesheke
Kazungula
Pandamatenka
Mashonaland
Matabeleland
Gwelo
Salisbury
Umtali
Beira
Chimoio
Manica
Sofala
Inhambane
Lourenco Marques
Delagoa Bay
Zululand
Natal
Durban
Pietermaritzburg
Port Elizabeth
Cape Town
Cape Colony
Orange Free State
Transvaal
Johannesburg
Pretoria
Kimberley
Bloemfontein
Basutoland
Griqualand West
Griqualand East
Kaffraria
Pondoland
Tembuland
Bechuanaland
Damaraland
Ovampoland
Great Namaqualand
Walfish Bay
Angra Pequena
Port Nolloth
Orange R.
Vaal R.
Limpopo R.
Molopo R.
Kuruman
Griquatown
Hopetown
Colesberg
Cradock
Graaff Reinet
Aliwal North
Ladysmith
Newcastle
Dundee
Utrecht
Wakkerstroom
Standerton
Heidelberg
Potchefstroom
Rustenburg
Zeerust
Mafeking
Vryburg
Taungs
Barkly West
Hay
Upington
Prieska
Calvinia
Clanwilliam
Malmesbury
Worcester
Paarl
Stellenbosch
Caledon
Swellendam
Mossel Bay
George
Knysna
Plettenberg Bay
Port Elizabeth
Uitenhage
Grahamstown
Alexandria
Bathurst
Kingwilliamstown
East London
Queenstown
Butterworth
Umtata
Kokstad
Matatiele
Harrismith
Bethlehem
Ficksburg
Senekal
Winburg
Kroonstad
Heilbron
Parys
Vredefort
Klerksdorp
Potchefstroom
Lichtenburg
Ventersdorp
Christiana
Bloemhof
Wolmaransstad
Delareyville
Setlagoli
Mafeking
Zeerust
Rustenburg
Pilansberg
Marico R.
Crocodile R.
Limpopo R.
Shashi
Kavirondo
Nyanza
Usukuma
Usambiro
Mwanza
Shinyanga
Kahama
Tabora
Unyanyembe
Ujiji
Uvinza
Ugogo
Mpwapwa
Kilimatinde
Mdaburas
Iringa
Mahenge
Kilwa
Lindi
Mikindani
Ibo
Quilimane
Chinde
Beira

CONGO FREE STATE - OROGRAPHICAL FEATURES, &c.

Scottish Geographical Magazine, 1906.
(Presented by J. G. Bartholomew.)

BRITISH EAST AFRICA
Bahr el Ghazal
UGANDA
Victoria Nyanza
Lake Tanganyika
GERMAN EAST AFRICA
NORTH EASTERN RHODESIA
BRIT. CENT. AFRICA
Lake Nyasa
Lake Rukwa
Lake Kivu
Albertville
Tabora
Kasongo
Loango
Cabinda
Equator
Avakubi
Fashoda
Lado
Nasser
Dannaba
Tamkia
Wadelai
Karuma
Entebbe
Kavirondo
Sese
Kisumu
Kilimatinde
Mpala
Kituta
Abercorn
Fife
Karonga
Langenburg
Fort Hall
Bismarckburg
Mpweapwe
Kasembe
Lofoi
Moena
Katanga
Mere Mere
Pio de Gerlache
Chiwala
Mapira
Mairi
Malambatha
Tenke
Kalonga
Chitambo
Mazawandi
Maranda
Chitimba
Kawende
Kambomba
Livingstonia
Chinteche
Chikanda
Chibwe
Kasungu
Mpesem
Mlanje
Port Herald
Blantyre
Zomba
Fort Johnston
Liwonde
Mt. Waller
Mt. Shiré
Mt. Elgon
Mt. Debasien
Mt. Kenia
Mt. Kilimanjaro
Mt. Meru
Mt. Hanang
Mt. Kasigau
Mt. Mlanje
Mt. Milanji
Mt. Waller
Mt. Shiré
Mt. Elgon
Mt. Debasien
Mt. Kenia
Mt. Kilimanjaro
Mt. Meru
Mt. Hanang
Mt. Kasigau
Mt. Mlanje
Mt. Milanji
Protest
Sc
Turtle I.
Anno Bom
Adams I.
St Thomas
River Congo
Pt Indienne
Pt Noire
Pt Palm
Batu Lagos
Massabi
Landana
Malemba
Kuilu
Luanga
Chiloango
Ganda
Desaix
Meshra er Rek
Rohl
Rohl
Amadi
Nasser
Dannaba
Gaba
Amatara
Gondokoro
Rejaf
Lado
Bedden
Tarrangole
Wadelai
Karuma
Entebbe
Kavirondo
Sese
Kisumu
Kilimatinde
Mpala
Kituta
Abercorn
Fife
Karonga
Langenburg
Fort Hall
Bismarckburg
Mpweapwe
Kasembe
Lofoi
Moena
Katanga
Mere Mere
Pio de Gerlache
Chiwala
Mapira
Mairi
Malambatha
Tenke
Kalonga
Chitambo
Mazawandi
Maranda
Chitimba
Kawende
Kambomba
Livingstonia
Chinteche
Chikanda
Chibwe
Kasungu
Mpesem
Mlanje
Port Herald
Blantyre
Zomba
Fort Johnston
Liwonde
Mt. Waller
Mt. Shiré
Mt. Elgon
Mt. Debasien
Mt. Kenia
Mt. Kilimanjaro
Mt. Meru
Mt. Hanang
Mt. Kasigau
Mt. Mlanje
Mt. Milanji

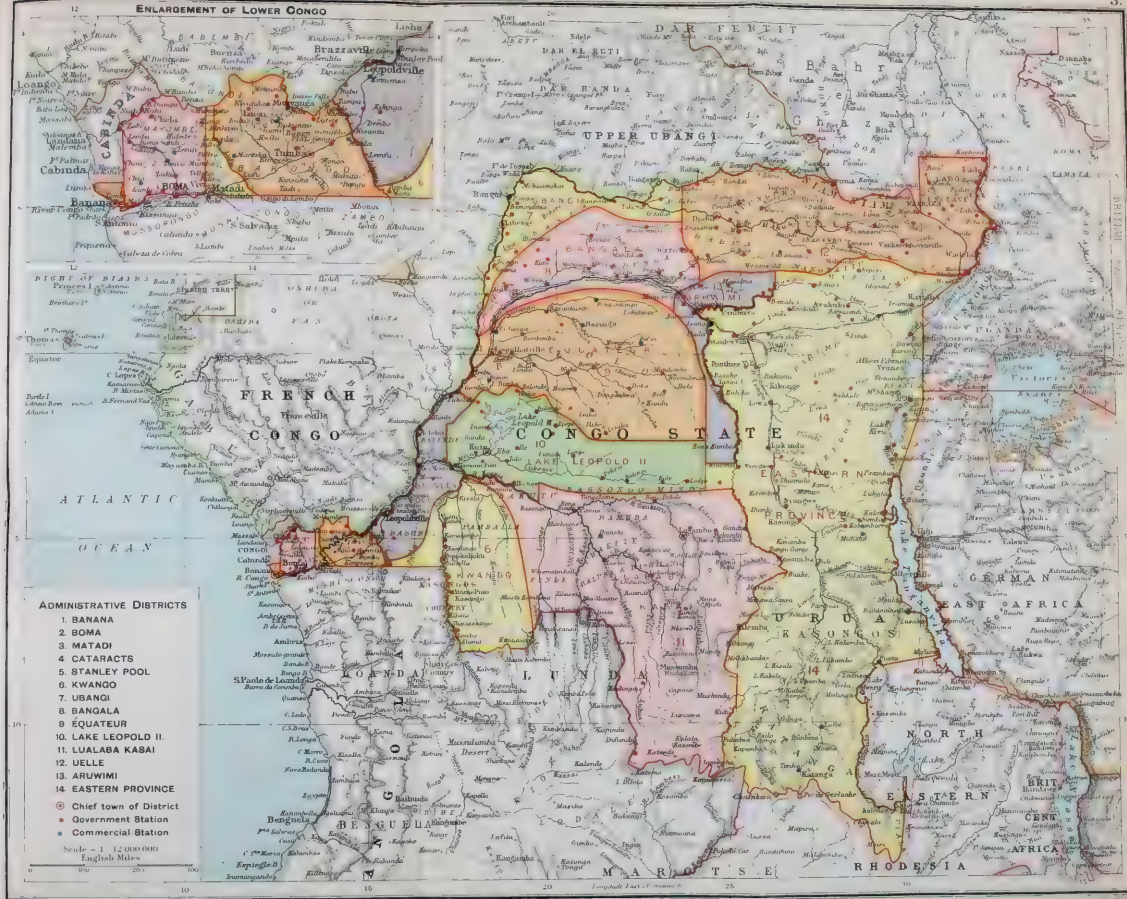
CONGO FREE STATE - VEGETATION FEATURES, &c.



(Presented by J. G. Bartholomew.)

Bahr el Ghazal
Ghazal
Lake Albert
Lake Victoria
Victoria Nyanza
Lake Tanganyika
Lake Rukwa
Lake Bangweolo
Lake Mweru
Lake Kivu
Lake Edward
Albert Edward Nyanza
Lake Kioga
Lake Leopold II
Lake Mai-Ndombe
Lake Upemba
Lake Kisale
Lake Kalomba
Lake Lubambo
Lake Dilolo
Lake Mweru Wantipa
Lake Chambezi
Lake Bangweolo
Lake Mweru
Lake Kivu
Lake Edward
Albert Edward Nyanza
Lake Kioga
Lake Leopold II
Lake Mai-Ndombe
Lake Upemba
Lake Kisale
Lake Kalomba
Lake Lubambo
Lake Dilolo
Lake Mweru Wantipa
Lake Chambezi
Lake Bangweolo
Lake Rukwa
Lake Tanganyika
Victoria Nyanza
Lake Albert
Ghazal
Bahr el
Loango
Cabinda
Landana
Malemba
Massabi
Kuilu
Kuilu Laz
Fort Desaix
Ganda
Jur Ghattas
Rumbekh
Meshra er Rek
Nasser
Dannaba
Taufikia
Amol
Gao
Aguil
Abwong
Nuer
Dinka
Jieng or
Bor
Wanbeck
Karbora
Lado
Bomas
Berri
Tamata
Ladoenclave
Mundri
Yei
Yambio
Maridi
Yirol
Rumbek
Tambura
Uganda
Pambuna
Propos M.
Kabuma
Kabwendi
Ombambas
Badinde
Limu
Munda
Nyangara
Dongu
Tangasi
Vankerckhovenville
Wadelai
Fabbi
Fadibek
Simule
Albert
Nimule
Gondokoro
Lado
Equator
Kibonge
Bakumu
Turtle I.
Anno Bom
Adams I.
Kavalli
Kavalles
Ibiti
Irumu
Avakubi
Bamaliya
Brothers I.
Princes
Bight of
Mangbati
Maibode
Mobeti
Idemani
Fangu
Lindi
Dawoni
Karima
Albert Edward Nyanza
Kiyanzi
Kivu
Lake Kivu
Kasenyi
Kasongo
Lukandu
Eastern
Province
Kasonga
Shumola
Mutoto
Nyangwe
Lukata
Kalombo
Kabambare
Kasongo
Mutesho
Kawamba
Zungu Gorge
Nassamba
Buabe
Albertville
Kabwezi
Uvira
Usumbura
Ujiji
Kigoma
Tabora
Ugogo
Ugunda
Kilimatinde Sta.
Mdaburua
Iseke
German East Africa
Administ
1. Ba
2. Bo
3. Ma
4. Ca
5. St
6. Kw
7. Ub
8. Bal
9. Équ
10. La
11. Lu
12. Ue
13. Ar
14. Ea
Ch
Go
Co
Uruwa
Kasongos
Kalomba
Lubambo
Kisale
Kabele
Upemba
Kubo Gorge
Loanza
Bela
Molinga
Gonga
Lofoi
Dinkeza
Moena
Tenke
Katanga
Pic de Gerlache
Mapira
Kalenda
Mpala
Luzumu
Lusaka
Kasenga
Kawambwa
Mpulungu
Abercorn
Kituta
Tungoi
Kahunda
Mpiri
Bismarckburg
Lake Rukwa
Ruga Ruga
Madenya
Pambachua
Kibiro
Utengule
Chilanga
Chinde
Mwenemanusha
Langenburg
Fort Hill
Karonga
Chinunwi
Livingstonia
Kondowe
Kambimbi
Nyassa
Lake Nyassa
Mwaniana
Hora
Makram
Mbampo
Bandawe
Chibwanas
Lugenda
Chitesi
Mazawamba
Kanyemba
Chinagula
Mlanduulu
Mpanda
Mpemba
Cape Maclear
Mpesani
Jameson
Mwami
Kasungu
Mwase
Mlanje
Zambesi
Shire
Luangwa
Luapula
Chambezi
Kafue
Kalungwisi
Chibwe
Fife
Chinde
Marukatu
Kazembe
Chingo
Moamba
Lusaka
Mapunga
Mapiri
Mere Mere
Bazi Swolo
Chitembo
Chitambo
Kalenda
Mpala
Muransa
Mpiri
Mwanda

CONGO FREE STATE - POLITICAL DIVISIONS



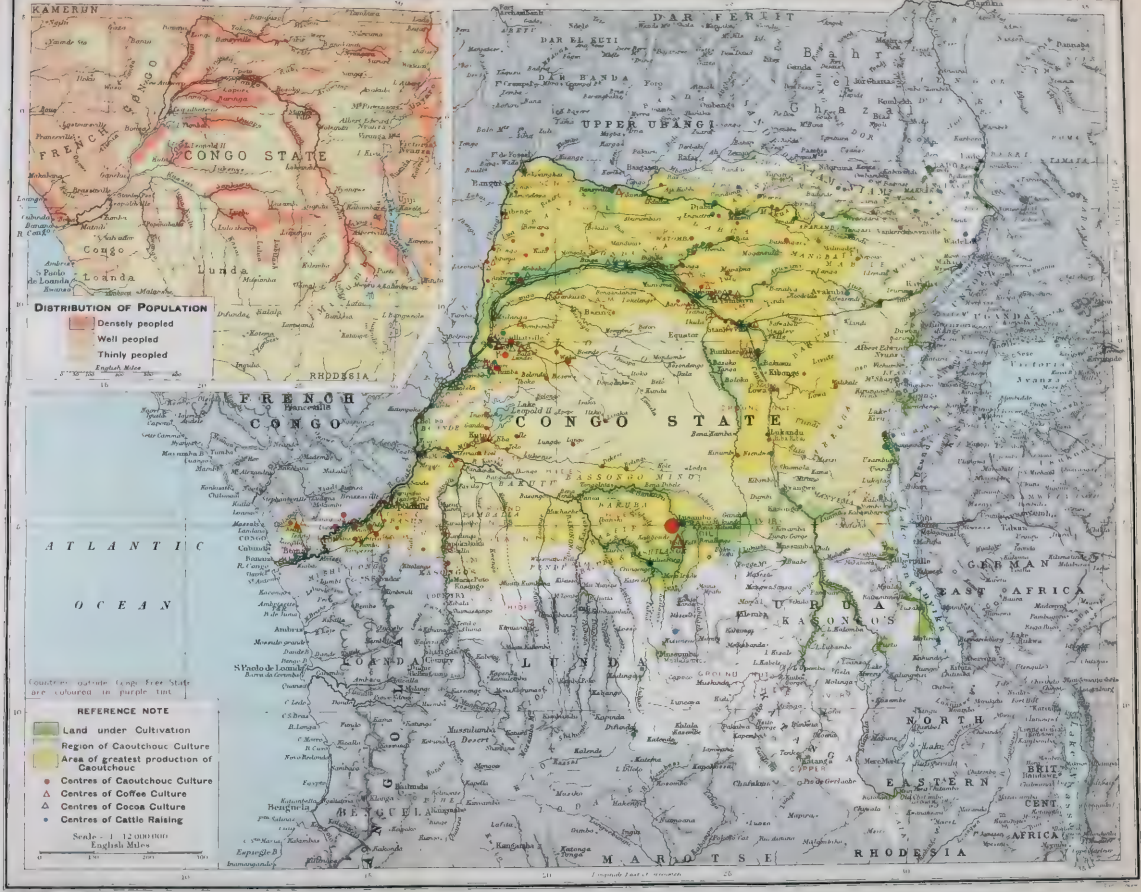
Administrative Districts

1. BANANA
2. BOMA
3. MATADI
4. CATARACTS
5. STANLEY POOL
6. KWANGO
7. UBANGI
8. BANGALA
9. ÉQUATEUR
10. LAKE LEOPOLD II.
11. LUALABA KASAI
12. UELLE
13. ARUWIMI
14. EASTERN PROVINCE

- Chief town of District
- Government Station
- Commercial Station

KAMERUN
FRENCH EQUATORIAL AFRICA
BELGIAN CONGO
ANGLO-EGYPTIAN SUDAN
UGANDA
BRITISH EAST AFRICA
TANGANYIKA TERRITORY
NORTHERN RHODESIA
NORTH EASTERN RHODESIA
CENTRAL AFRICA
GERMAN EAST AFRICA
Bahr el Ghazal
Lake Victoria Nyanza
Lake Albert Nyanza
Lake Kivu
Lake Tanganyika
Lake Nyasa
Lake Rukwa
Lake Bangweulu
Lake Mweru
Lake Kalomba
Lake Mweru Marsh
Countries are coloured
Language
Region
Area
Cent
Cent
Cent
Cent
DISTRIBU
Tawfikia
Nasser
Dannaba
Gondokoro
Lado
Wadelai
Albertville
Kibonge
Lukandu
Avakubi
Kasongo
Nyangwe
Kabambare
Usumbura
Kigoma
Ujiji
Tabora
Mpala
Abercorn
Fife
Chinde
Beira
Tete
Zumbo
Blantyre
Port Herald
Fort Jameson
Fort Rosebery
Broken Hill
Livingstonia
Karonga
Fort Hall
Langenburg
Kilimatinde
Iringa
Mpwapwa
Dodoma
Kondoa Irangi
Mwanza
Shashi
Kisumu
Kavirondo
Victoria Nyanza
Mumia's
Entebbe
Mengo
Fort Victoria
Salisbury
Umtali
Chimoio
Quelimane
Cape Maclear
Fort Jameson
Abercorn
Kasama
Tabora
Mpwapwa
Dodoma
Iringa
Kilimatinde
Langenburg
Fort Hall
Karonga
Fife
Chinde
Beira
Tete
Zumbo
Blantyre
Port Herald
Fort Rosebery
Broken Hill
Livingstonia
Mwanza
Shashi
Kisumu
Kavirondo
Victoria Nyanza
Mumia's
Entebbe
Mengo
Fort Victoria
Salisbury
Umtali
Chimoio
Quelimane
Cape Maclear

D'S MAP, 1610



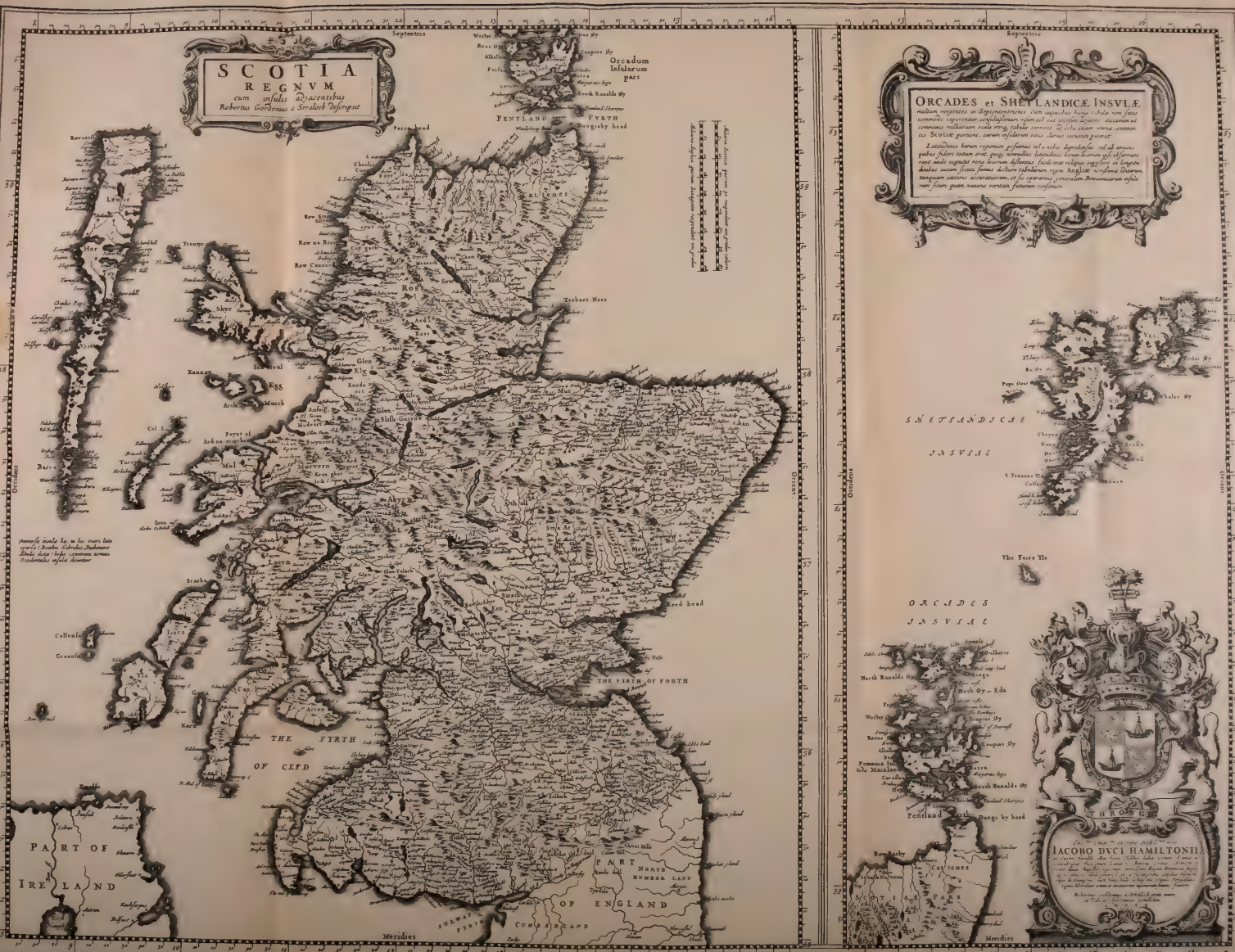
(Presented by J. G. Bartholomew.)

D'S MAP, 1610

Reproduced at Bartholomew's Geographical Institute

OF STRALOCH'S MAP, 1653

Reproduced at Bartholomew's Geographical Institute.



Reproduced at Bartholomew's Geographical Institute

G
7
S43
v.21

The Scottish geographical magazine

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY

BROWN BROS. LTD.
BOOKBINDERS,